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APRIL

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SEE PAGE 33

NEW INVENTIONS · MECHANICS · MONEY MAKING IDEAS
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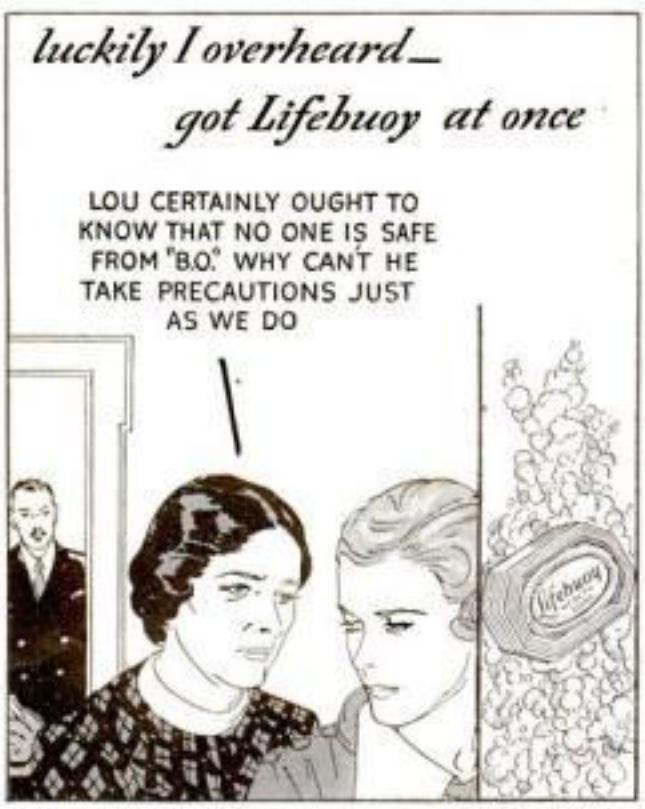
BLINDLY SHE LOVED–BLINDLY HE OFFENDED



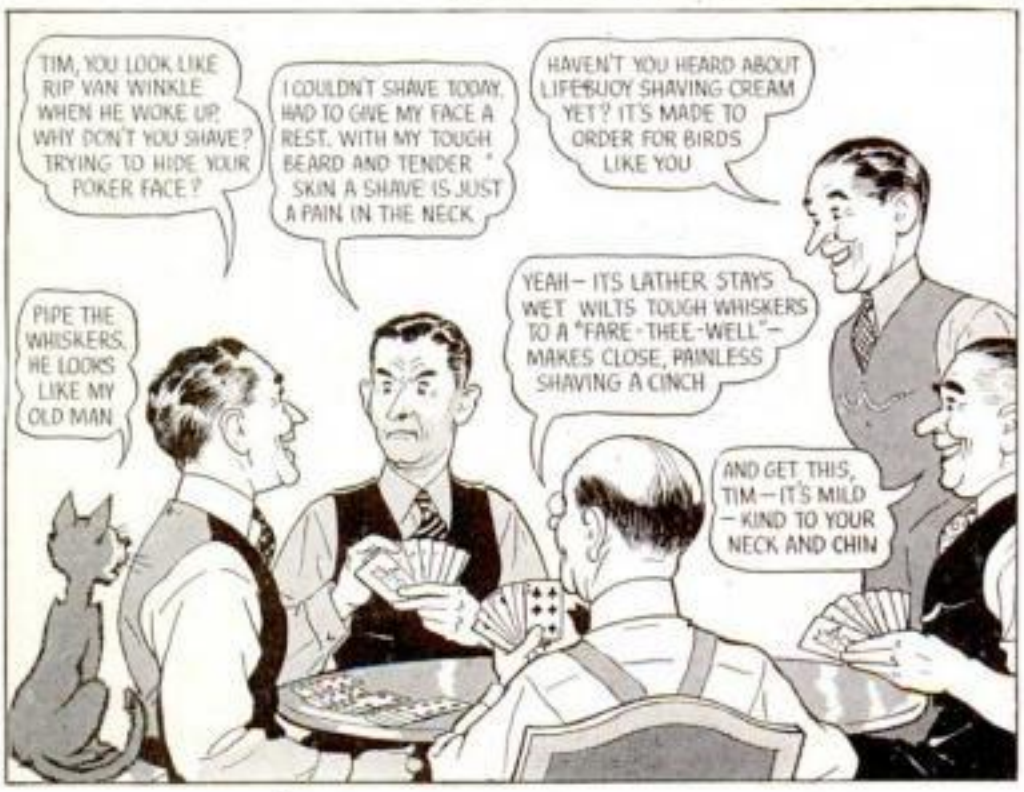
LET your complexion choose its soap—you'll find it chooses Lifebuoy. Massage this rich lather well into pores. Rinse, discover how clean, *fresh* it leaves your skin. According to scientific skin tests, Lifebuoy is more than 20% milder than many so-called "beauty soaps." Yet this soap purifies, *deep-cleanses* face and body pores alike! No wonder complexions love it!

Whose turn next?

No one is safe from "B.O." (*body odor*), if *unprotected!* Bathe regularly with Lifebuoy. Its clean scent vanishes as you rinse.

Approved by Good Housekeeping Bureau.

"TENDER FACE" TIM SAVES HIS CHIN



SHAVERS, here's good news! Lifebuoy Shaving Cream lather holds 52% more moisture. Soaks tough whiskers *extra soft*—so you can shave clean, close and often—without scraping your face raw and sore. It's decidedly milder, too—soothing to tender skin.

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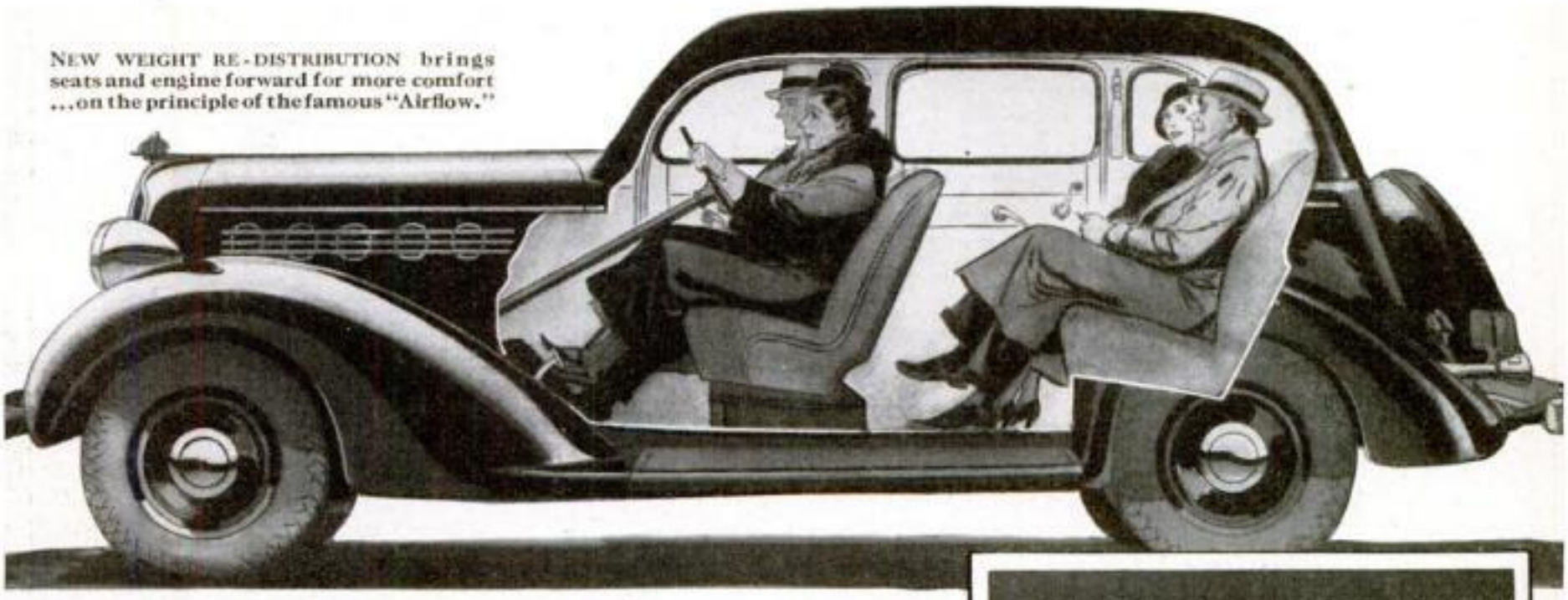
Try it. Write Lever Brothers Co., Dept. A-144, Cambridge, Mass. for a Free 12-day tube. *This offer good in U. S. and Canada only.*

Straight Facts about PLYMOUTH'S startling "FLOATING RIDE"



NEW WEIGHT RE-DISTRIBUTION brings seats and engine forward for more comfort ...on the principle of the famous "Airflow."

Showing How "Back-Seat Bounce" and "Spring Gallop" were Outlawed by New Plymouth Engineering Principles

PLYMOUTH'S "FLOATING RIDE" has been called the year's greatest advance in riding comfort. As one engineer put it—"I've never before driven a car like this. It 'glides' over bumps and ruts as if they didn't exist!"

Like all outstanding engineering feats, Plymouth's "Floating Ride" originated with a fundamental change in car design.

The old conventional method of distributing car weight called for stiff springs in the front, where weight was less, and long, flexible springs in the rear, where the weight was greater.

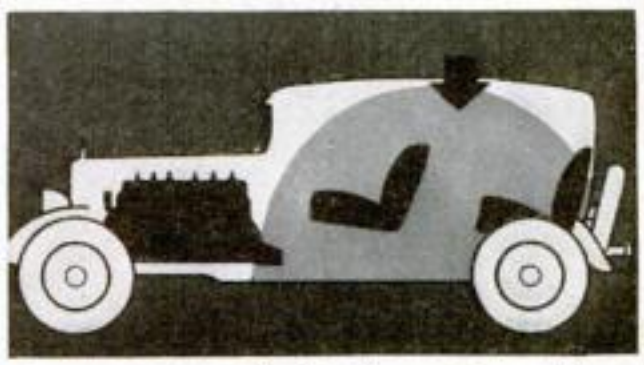
This spring variation brought about uneven, "galloping" action when the car hit bumps.

Plymouth engineers began by redistributing car weight on the principle proved by over a hundred million miles of travel in last year's famous "Airflow." They moved engine and seats *forward.*

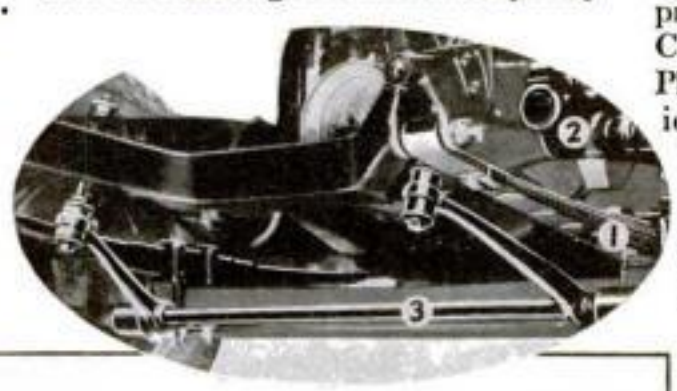
Result? Back-seat riders sit forward of the rear axle, away from bumps and "spring gallop." There's more leg-room and comfort.

Then Plymouth engineers developed a new kind of stronger, "livelier" front spring made of "Mola" Steel . . . which aids in reducing oscillation frequency to 90 per minute, compared to 135 per minute in an ordinary car. They added a sway eliminator at the front to give new safety on curves.

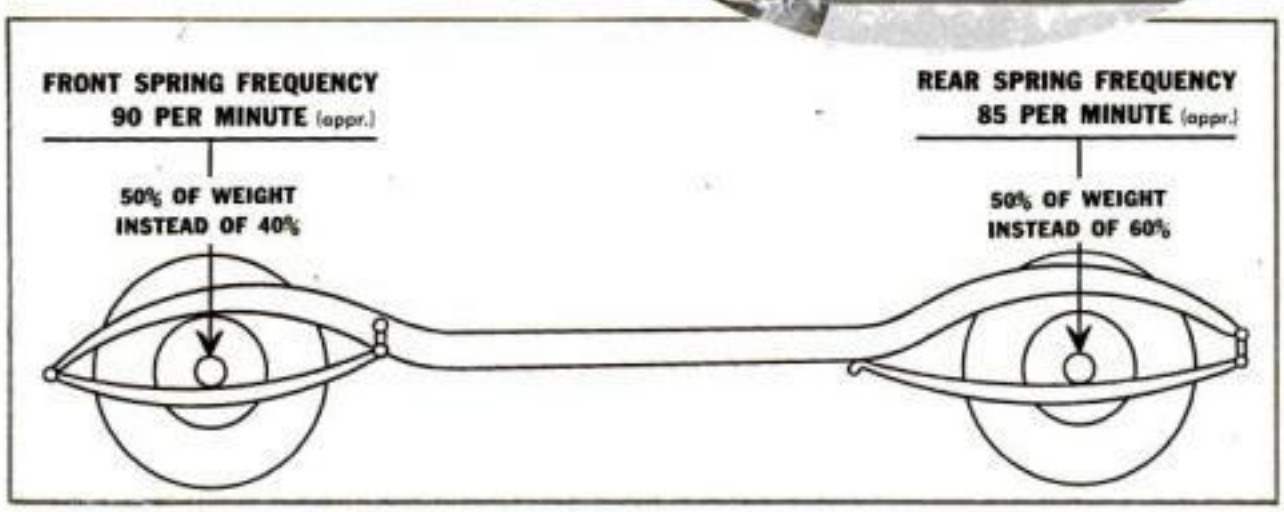
Go in to see these history-making improvements at any Dodge, De Soto or Chrysler dealers. They have the new Plymouth on display. Drive it. Convenient purchases by the Official Chrysler Motors Commercial Credit Plan.



ORDINARY CAR, showing the engine position. Center of weight is in the rear. Back-seat passengers sit directly over the axle, receiving not only the road-shocks but also the "spring gallop."



Left: Plymouth's New Front Spring Assembly: (1) Semi-Elliptic Springs of new "Mola" Steel; (2) Double-action Shock Absorbers; (3) Sidesway Eliminator.



PREVIOUSLY, about 40% of the car weight was on the front axle—60% on the rear axle. Plymouth's Correct Weight Re-Distribution divides axle load equally, opens way for new spring coordination . . . introduces a stronger, safer, better-riding and longer-lasting car.

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FEATURES AND DEPARTMENTS

Cover design by EDGAR F. WITTMACK

AUTOMOBILES

AVIATION

How I Improved My Memory In One Evening

The Amazing Experience of Victor Jones

"Of *course* I place you! Mr. Addison Sims of Seattle.

"If I remember correctly—and I *do* remember correctly—Mr. Burroughs, the lumberman, introduced me to you at the luncheon of the Seattle Rotary Club three years ago in May. This is a pleasure indeed! I haven't laid eyes on you since that day. How is the grain business? How did that merger work out?"

The assurance of this speaker—in the crowded corridor of the Hotel St. Regis—compelled me to look at him, though it is not my habit to "listen in" even in a hotel lobby.

"He is David M. Roth, the most famous memory expert in the United States," said my friend Kennedy, answering my question before I could get it out. "He will show you a lot more wonderful things than that, before the evening is over."

And he did.

As we went into the banquet room the toastmaster was introducing a long line of the guests to Mr. Roth. I got in line and when it came my turn, Mr. Roth asked, "What are your initials, Mr. Jones, and your business connection and telephone number?" Why he asked this, I learned later, when he picked out from the crowd the 60 men he had met two hours before and called each by name without a mistake. What is more, he named each man's business and telephone number.

I won't tell you all the other amazing things this man did except to tell how he called back, without a minute's hesitation, long lists of numbers, bank clearings, prices, parcel post rates and anything else the guests gave him in rapid order.

*****

When I met Mr. Roth—which you may be sure I did the first chance I got—he rather bowled me over by saying, in his quiet, modest way:

"There is nothing miraculous about my remembering anything I want to remember, whether it be names, faces, figures, facts, or something I have read.

"*You can do this as easily as I do.* Anyone with an average mind can learn quickly to do exactly the same things which seem so miraculous when I do them.

"My own memory," continued Mr. Roth, "was originally very faulty. Yes it was—a really *poor* memory. On meeting a man I would lose his name in thirty seconds, while now there are probably 10,000 men and women in the United States, many of whom I have met but once, whose names I can call instantly on meeting them."

"That is all right for you, Mr. Roth," I interrupted, "you have given years to it. But how about me?"

"Mr. Jones," he replied, "I can teach you the secret of a good memory in one evening. This is not a guess, because I have done it with thousands of pupils. In the first of seven simple lessons which I have prepared for home study, I show you the basic principle of my whole system and you will find it—not hard work as you might fear—but just like playing a fascinating game. I will prove it to you."

He didn't have to. His Course did; I got it the next day from his publishers.

When I tackled the first lesson, I suppose I was the most surprised man in forty-eight States to find that I had learned—in about one hour—how to remember a list of one hundred words so that I could call them off forward and back without a single mistake.

That lesson *stuck*. So did the other six.

Read this letter from one of the most famous trial lawyers in New York:

> "May I take occasion to state that I regard your service in giving this system to the world as a public benefaction. The wonderful simplicity of the method, and the ease with which its principles may be acquired, especially appeal to me. I may add that I already had occasion to test the effectiveness of the first two lessons in the preparation for trial of an important action in which I am about to engage."

This man didn't put it a bit too strong.

The Roth Course is priceless! I can *count* on my memory now. I can call the name of any man I have met before—and I keep getting better. I can remember any figures I wish to remember. Telephone numbers come to mind instantly, once I have filed them by Mr. Roth's easy method.

The old fear of forgetting has vanished. I used to be "scared stiff" on my feet—because I wasn't *sure*. I couldn't remember what I wanted to say.

Now I am sure of myself, confident, and "easy as an old shoe" when I get on my feet at the club, at a banquet, in a business meeting, or in any social gathering.

The most enjoyable part of it all is that I am now a good conversationalist—and I used to be as silent as a sphinx when I got into a crowd of people who knew things.

Now I can call up like a flash of lightning most any fact I want right at the instant I need it most. I used to think a "hair trigger" memory belonged only to the prodigy and genius. Now I see that every man of us has that kind of a memory if he knows how to make it work.

I tell you it is a wonderful thing, after groping around in the dark for so many years to be able to switch the big searchlight on your mind and see instantly everything you want to remember.

This Roth Course will do wonders in your office.

Since we took it up you never hear anyone in *our* office say "I guess" or "I think it was about so much" or "I forget that right now" or "I can't remember" or "I must look up his name." Now they are right there with the answer—like a shot.

Here is just a bit from a letter of a well-known sales manager up in Montreal:

> "Here is the whole thing in a nutshell: Mr. Roth has a most remarkable Memory Course. It is simple, and easy as falling off a log. Anyone—I don't care who he is—can improve his Memory 100% in a week and 1,000% in six months."

My advice to you is don't wait another minute. Send for Mr. Roth's amazing course and see what a wonderful memory you have got. Your dividends in *increased power* will be enormous.

VICTOR JONES.

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So confident are the publishers of the Roth Memory Course that you will be amazed to see how easy it is to double, yes, triple your memory power in a few short hours, that they are willing to send the course on free examination.

Don't send any money. Merely mail the coupon and the complete course will be sent, all charges prepaid, at once. If you are not entirely satisfied send it back any time within five days after you receive it and you will owe nothing.

On the other hand, if you are as pleased as are the thousands of other men and women who have used the course send only $3.50 in full payment. You take no risk and you have everything to gain, so mail the coupon now before this remarkable offer is withdrawn. Walter J. Black, Inc., Dept. 504, 2 Park Avenue, New York, N. Y.

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Please send me, in a plain container, the Roth Memory Course of seven lessons. I will either remail the course to you within five days after its receipt or send you $3.50.

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POPULAR SCIENCE MONTHLY FOR APRIL, 1935

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Here are two ways of lighting your desk for close work or for study. At the right, the direct way. Note the sharp contrast and the glare. Below, a lamp giving both direct and indirect illumination, so as to do away with all harsh differences of light and shade. The better method is obviously this

Testing the Lights

IN YOUR OWN HOME

By R. M. BOLEN

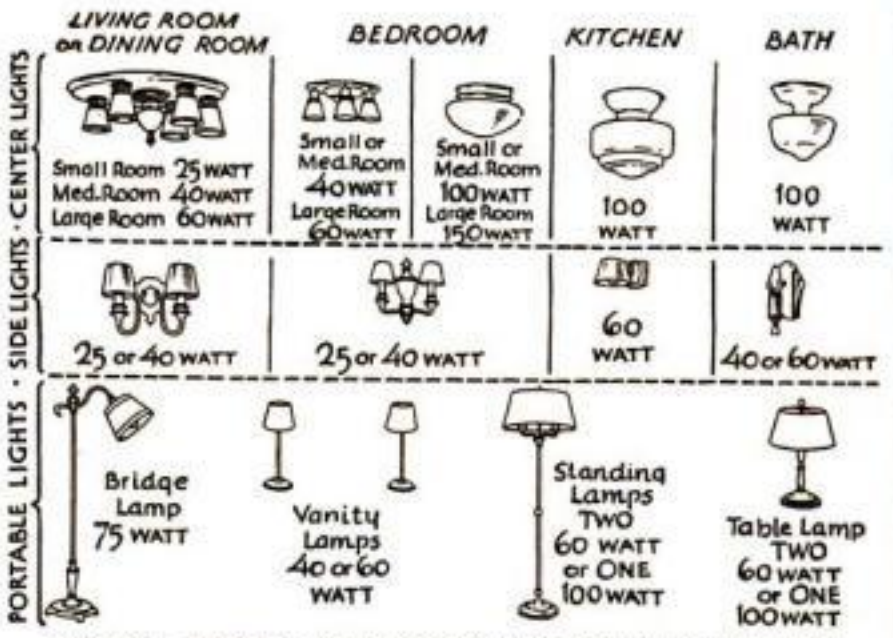
Secretary, Popular Science Institute

ACCURATE tests have replaced haphazard judgment to put house lighting on a scientific basis. At one time, any light was a good light regardless of its size, location, or use. Now, trained experts attack lighting problems in laboratories and manufacturers run extensive tests to determine just what lamp designs give the best in illumination.

By following a few simple rules, even you as a householder can perform interesting tests that will help you obtain good lighting in your home.

First of all, make sure that your lamps and fixtures are fitted with the proper bulbs. Provided with the special chart below, make a tour of your rooms; checking the lights as you go, and making a list of the bulbs needed to fill empty sockets and replace undersize units. Remember, an excess of light is less dangerous than too little. Illuminating engineers have found that it is practically impossible to get too much light if it is properly applied.

Along this line, Dr. Mathew Luckiesh, noted lighting expert, recently completed a series of fascinating tests. Using more than a thousand human subjects, he first seated each under an ordinary bridge lamp fitted with a medium-power bulb (60-watt) and asked him to read from a page of fine print. As the subject read with acknowledged ease, Dr. Luckiesh measured the illumination on the page with a small light meter. In each case, he found



This chart will help you fit your fixtures with the proper bulbs

it to be less than ten foot candles.

As a second step in the test, the printed page was placed in a mysterious rectangular black box, constructed like a miniature stage and fitted with a carefully concealed source of light the brilliance of which could be controlled by a convenient knob on the front panel.

STARTING with the light dim, Dr. Luckiesh then asked his subjects to turn the knob and increase the illumination until the printing could be read with the greatest ease. In almost every case, a light meter substituted for the page at the end of the experiment showed illumination of more than three hundred foot candles—close to forty times the light given by the original bridge lamp. If our eyes could talk, believes Dr. Luckiesh, they would ask for many times the light we normally give them.

From another set of tests recently completed, lighting engineers have formulated rules to govern the design of lamps used for reading, sewing, and close work. If you desire, you can apply them to the lamps in your home. For the most part, an ordinary tape measure is the only tool required.

To start with, shades for bridge, table, or reading lamps should meet three general requirements. First, they should be translucent, but not so translucent that the position and shape of the lighted bulb is clearly defined. Second, they should be light in color; light, or medium cream, ivory, or rose being the preferred tints. And third, they should be of the open top variety.

To test the general proportions of your favorite bridge lamp, place your eyes about thirty-eight inches from the floor (in a normal sitting position) and about two feet away from an imaginary line drawn vertically down through the center of the bulb. If the lamp is properly constructed, no portion of the bare bulb should be visible. There should be no glare and no marked light and dark contrast.

These same test dimensions can be applied to lamps used on end tables. In testing a table lamp, however, the eyes should be thirty-eight inches from the floor and thirty-two inches from the center line of the lamp.

IN RECOMMENDING the best design for reading and study lamps, lighting experts have been even more specific. Lamps supplying indirect as well as direct light have been found to be easiest on the eyes, avoiding glare and sharp contrasts between light and dark. The standard or main center post should be high enough to place the bottom edge of the shade nineteen and one half inches above the top of the table, while the shade itself should have a bottom diameter of sixteen and five eighths inches, a top diameter of eight inches, and an overall height of eight and one half inches.

By giving these specifications, engineers in no way condemn the artistic lamps used purely as decorations. They merely advise against their use as illumination for close work. Decorative lamps have their place in every home, but that place should not be next to your favorite reading chair.

Our Readers Say

Hungry Boys Stop Eating When Signal Light is Red

WHEN the Aberdeen, Scotland, battalion of the Boys' Brigade goes to camp, it carries with it a remarkable robot for use in the boys' mess. The robot is a signal made of three lamps,—red, yellow, and green (as in a traffic signal)—mounted on a vertical board rising from a base that contains a motor battery and switches. When the padre, or commanding officer, is to say anything to the boys, he switches on first the yellow light, for warning that silence is desired, then the red light for complete cessation of eating and talking. The green light signifies that the boys may eat, or, if their meal is over, that they may leave the table. We have found the signal very satisfactory; it impresses visitors much more favorably than the more customary blowing of a whistle or shouting. Perhaps my description of our messroom signal will interest readers on your side of the ocean and lead them to imitate it. I should be most happy to learn what they think of our idea.—J.R.K.P., Aberdeen, Scotland.

His Two-Tube All-Electric Set Can do Wonders

I WANT to applaud you for the fine radio hook-ups you have published lately. Keep up the good work. While looking over the letters in a recent issue I have seen that other readers feel much as I do about all-electric sets. I wish to support J.M., Wapakoneta, Ohio, in his request for a two-tube all-electric set. It so happens that I own one of these sets. I find that it can do wonders for its size. As I have said, you have been doing fine along the all-electric line, and I am all for it. By the way, you might also put in an article about repairing typewriters. You'll notice that mine doesn't print the tops of the letters plainly. Ha!—R.Y., Smithville, Ohio.

Wants to Make a Sloop And Cruise Four Years

ABOUT the suggestion of J.P., Lafayette, Ind., anent the building of a twenty- or twenty-five-foot sloop. If you were to publish plans of such a boat I would appreciate it quite a lot. I am at present and have been traveling around the West some but plan eventually to land back in L.A. I have read Harry Pidgeon's book about his four-year cruise and have a desire to duplicate his performance with a boat just as large or slightly larger than his. May I mention, in passing, that I have not missed more than two issues of POPULAR SCIENCE MONTHLY in the last three years? Perhaps one of these days I can be enjoying myself at sea in my sloop thinking of you all at home.—R.S.L., Lead, S. Dak.

Some Drivers Think They're Cowboys Herding Cows

IN A recent issue, R.A.S. says that truck drivers are ideal drivers and that Fred Frame is all wet. R.A.S. apparently has not had enough experience to tell a good driver from one that merely *herds* a car. Fred Frame's rules are very fine, if you disagree with him. To be safe, just keep driving the opposite of what he says. As for truck drivers, they are road hogs, first, last and always; and a road hog is never a good driver. My state produces good drivers. I don't say this because I am egotistical and think they are more talented than others, but because narrow, unsurfaced mountain roads force them to be.—W.K., Rockvale, Col.

Vouches for Hoop Snake; One Chased Him, He Says

I HAVE been a reader of POPULAR SCIENCE MONTHLY for a number of years, and note in a letter from E.P., Bloomfield Hills, Mich., a reference to the "hoop snake" which some people say never existed, and others say now is extinct. I suppose there are really not many snakes of this kind, but tell him not to fool himself, for there *were* snakes of this kind. Fifty years ago I was fortunate to have the pleasure of having one follow me and I was not long in getting away from him. As I was going to the barn to feed the stock, I happened to look back, and there he came rolling after me. I got out of his way without wasting any time, I can tell you. He went into the barn and I called for help. He measured about six feet.—J.A.McK., Jeffersonville, Ohio.

Aims to be a Cut-up But a Scientific One

I AM interested in experimenting with guinea pigs. I would, and I am sure many others would appreciate articles on this work. Tell us how to make a cheap but efficient dissecting board, also how to make a sterilizer for instruments, and what kind of instruments to use in dissecting. By what means could a specimen be kept fresh?—L.R., Spring Valley, N. Y.

Yes, E.S.S., but Running Suits Don't Have Coat Tails

IN REPLY to L.S.H. of Philadelphia concerning his letter relative to speed and time required to encircle the earth; in my estimation the speed of his brain should be increased sixty times to make it function at the normal rate. By increasing his calculated speed per second by sixty, he will obtain distance covered in one sixtieth of a second, and not zero time. If L.S.H. could reach his desired speed, he might see his dust at the starting point but he couldn't grab his coat tails. Incidentally, has he done anything about figuring out his stopping ratio? He might need one.—E.S.S., West Cornwall, Conn.

Who Wants Half of a Horse Anyway? Half of a Man?

HERE is a problem for some of the other readers. I hope they won't have too much trouble solving it. It isn't any too easy. A man had three sons. When he died, he left seventeen horses for his three sons. One of them got one sixth of the horses; another son got one third of the horses and the last son got one half of the horses. How were the horses divided so that each son got his allotted share, without breaking a horse in half?—R.B., Bowers, Pa.

J. M. D. Likes His Hydroplane Made from Our Blueprint

ABOUT a year ago I got from your blueprint department, plan for the hydroplane "Scram". I wish to compliment your designer on that plan; the boat certainly works like a charm, even though my work on it was far from being perfect.

I would be very much interested in seeing an article on racing fluids, for outboards. I have heard what they are made of, but have never seen the formulas. Also, I have read that good drivers can make a boat jump into the air, as far as thirty feet and as high as eight. How is this done? How about an article on streamlining a hull? This is what they are doing most now to speed up the hulls, according to an article that I read the other day. Here's to your good work and a good magazine. Keep it up.—J.M.D., Pelican Rapids, Minn.

Paris Reader Writes of Mystical Cure for Snake Bite

CURRENT throughout India is a belief that a certain creature called the Nag has in its head a jewel-like object such as was once reputed to be found in the head of a toad, that sucks up the poison of the deadliest snake, if it is immediately applied to the wound. The sophisticated or the cynical might think this story incredible, and yet, strangely enough, in 1920 the collector for the district of Wadhvan stated in his official report to the British Government that a Parsi gentleman possessed this precious jewel and by it saved the lives of many natives and also the lives of some officials working in the jungle. A ruling prince of India is said to have offered thousands of rupees for the jewel, but the magnitude of the offer made no impression upon the Parsi, a

gentleman of considerable personal wealth himself.—S.S.C., Paris, France.

If You Prospect For Gold Here's a Chance for You

As a purchaser and reader of your publication, viz., Popular Science Monthly, since its existence, I respectfully ask if by chance some reader of the Our Readers Say section can advance a hint on how I might solve the following problem. Last spring my ring finger became swollen from ivy poisoning; consequently I transferred the ring to the next finger which was a little too small for the exceptionally heavy gold-studded ring. Motoring along a road near my home, I waved my hand to a neighbor, and the motion of my arm caused the ring to slip off into the brush along the road. I have made minute searches, but thus far I have failed to locate it. I know it is still there, and that nobody has found it, for if anyone had, I believe I would have heard it, all right.—G.C.K., Whippany, N. J.

Fish Take Life With a Pinch of Salt

I have found a very good kink for fellows who keep fishes in aquariums; it is to add a small quantity—just a pinch or so—of salt to the water every two weeks. This dose of medicine will keep the fishes healthier, because most bacteria cannot grow very well in slightly saltish water. I have had my aquarium now for three years and no fishes have yet died of disease.—M.K., Chicago, Ill.

Botanist Who Knows His Onions Can Win Fame

Perhaps some botanist who knows something about breeding flowers and vegetables could work out a method of combining those two delectable viands of the table, the onion and the radish. As for me, I am a farmer, to whom the coming of spring means a lot of hard work and also a lot of big eating, and especially I look forward to the appearance of green onions on my supper table, and little red radishes. If some genius could only combine the two he could get famous overnight as the first to grow the radion, or perhaps it would be the onyish. M-m-m-m! I can smell how good it would taste, with fine homemade butter and crusty bread right out of the oven! I tell you I wouldn't swap a meal of onyishes or radions or whatever we are going to call them, for any of those fancy city dishes with the long names. My! I must be a mite hungry. I guess I'll go downstairs and peck around a bit.—C.H.H., Califon, N. J.

Cry for Help Comes From Snowbound Saskatchewan

Am a regular reader of your magazine, and like it fine. I have been scanning its pages for some time, hoping you would give us an article on snowmobiles. Being unable to use a car between December and April, on account of heavy snows, I think a lot of people up in this section of Canada would benefit by an article of that nature to provide them, possibly, with a means of getting around during the winter for business and social purposes, such as calling on our neighbors. Certainly we could use a snowmobile.—O.O., Kinistino, Sask.

Workers in Hot Lead, Do You Know This Secret?

A.H.A. of Egg Harbor, N. J., asks how to prevent melted lead from splattering. I believe his trouble is due to moisture in the crucible. The crucible must be preheated before starting to melt lead. Any cold object will sweat when heated. This moisture, when mixed with melted lead, will cause the lead to splatter. Hot lead must never be poured into a cold mold if you want to avoid trouble and possible injury.—G.T., Berkeley, Calif.

Barefoot Boy of Years Ago Had Grand Time Afield

Relative to snakes swallowing their young, I have just read two letters on the subject; one from W.P.A., of Arkansas, the other from Mrs. J.H.B., Bakersfield, Vt. Some scout the idea as contrary to reason, but I am on the positive side of the argument. Born on a farm in Jacksonville, Vt., I roamed the fields as a child, like all farm children, until I was twelve years old. One day when I was ten or eleven years old, which would be forty-nine years ago, while playing in the apple orchard below the house, I nearly stepped on a very small snake. As I moved aside, I saw another one; then, suddenly, I was aware there were many little fellows all around me. Being barefoot, and easily surprised by strange objects underfoot, I jumped aside and turned and looked at them. I saw an old snake, a common harmless striped one, its mouth wide open; all the little snakes crawled into it. It got away while I was looking for a stick or stone with which to kill it. I distinctly remember the incident, the old tree and the bar-way nearby leading to the berry lot. Several years ago, while looking over the farm, I saw the very apple tree, and standing under it, meditated, living over again those happy younger days. Some of the grandest times I ever had, I enjoyed as a barefoot boy in the country.—B.A.C., Brattleboro, Vt.

Much Obliged, R. K.— We're Glad You Think So

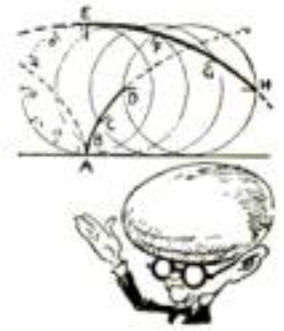
It may interest you to know that having read most of the mechanical scientific magazines on the market, I have turned to Popular Science Monthly exclusively. It certainly is one swell magazine. I especially like the radio and aviation articles. Keep up the good work.—R.K., Angola, Ind.

This Microscope Fan Wants To Build a Telescope

In Our Readers Say I just read a plea for something on amateur telescope mirror construction, and it affected me so much that I thought I would write in, in urgent support. I.N., of Coeur d'Alene, Idaho, has put into words something that I have had in mind for a long time, something which might do the seemingly impossible,—improve my favorite magazine. It has just about everything—my laurels go to the articles on the microscope—but here's one citizen who will exhaust his superlatives when the articles begin to come on making, mounting and using, say, a four- to six-inch reflecting telescope. But please don't make it cost too much; the more of the work we can do for ourselves, the happier we'll be. Here's thanking you for all the delights you dish out every month. I am much interested in the opportunities such a plan as I have brought out would give readers all over, to watch the stars. We could then make ourselves planetariums, too, to add to our pleasure as astronomers. Let us do most of the work.—E.Y., Wolfville, Nova Scotia.

That Wheel Problem And Two Theories

The question of H.W.M., of Catasauqua, Pa., interests me very much. He asks "Which part of the wheel travels farthest?" I am enclosing a diagram and my explanation. As point one travels from A to B to C to D, point seven travels from E to F to G to H. The wheel has made one quarter of its revolution on road XY. It can easily be seen that the locus of point seven is longer than that of point one. However, during the next quarter revolution, point one will travel a distance equal to locus EH, and point seven will travel a distance equal to locus AD. Thus, on completion of a half revolution of the wheel, both points will have traveled equal distances.—D.O.V., Kingston, N. Y.



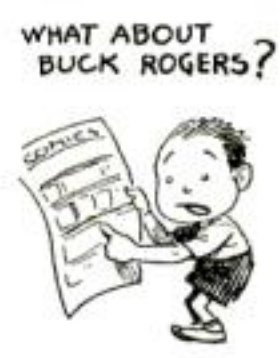
To solve the wheel problem, cut out a six inch disk. Punch two holes near the edge, to represent A and E. Hold the disk by a nail thrust through its center. Then roll the disk along the baseboard, and hold a pencil point without slipping, in one hole, so as to draw a curve indicating its path during one revolution. Then perform the same action holding the pencil in the other hole.—A.V., New York, N. Y.

Do You Think This Gasoline And Steam Engine Would Work?

Is this idea practical? I should like the opinion of readers of Popular Science Monthly. Remove the cast-iron manifold of a four-cylinder automobile engine, and replace it with a manifold of copper. Around this fit a boiler about seven inches in diameter, insulated, and containing in its top four small injectors such as are used on Diesel engines. The injector pumps are to be operated from the cam shaft. Under compression, the exhaust manifold would get very hot, and act as a dry, flash-type boiler, when the injectors sprayed water upon it. To the front of the engine we would add two cylinders, fitted with valves to use the steam generated by the boiler. The crankshaft would be at right angles to the automobile engine. The two steam pistons would give power on each down stroke, sufficient to produce the smoothness and power of an eight-cylinder engine on the fuel consumption of a four-cylinder engine.—A.M.C., Port Angeles, Wash.

Philosophers Have Racked Their Brains On This

Why can't man control time? That is the question that arose in my mind the other night as I read an adventure story about a man, who, through the use of a machine of his own invention, could wander among the centuries of the past and the future. Of course the idea in the book was rather hidden, but at least it got me thinking. Again, I say, why can't man control time? I wish some of you geniuses would get to work on the problem. Although I have taken this magazine for only three of its sixty-three years, I think I can say that it is, was and shall be, the best on the market.—J.R.G., Berwick, Pa.



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the safety of solid STEEL
over your head
Sensational new
FISHER "TURRET TOP"*

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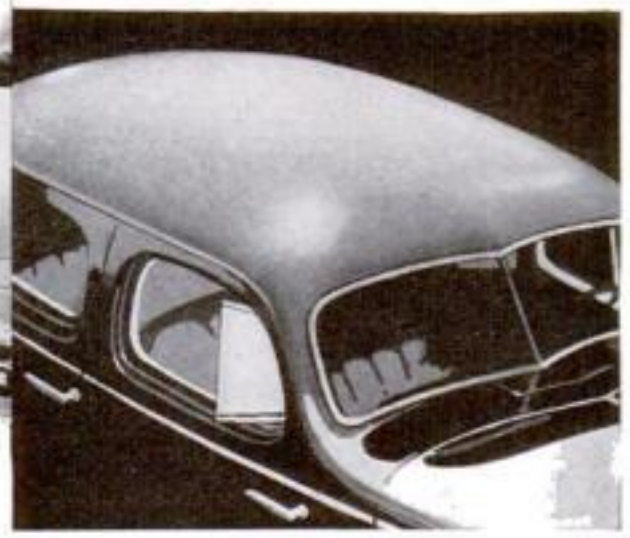
The turret of the modern battleship, arched and crowned for strength, is the highest development of the principles utilized by Fisher in the new solid steel "Turret Top" for closed cars



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Closed car models for 1935

AS THE largest makers of automobile bodies in the world, we have been working for years to perfect a *safety* roof of solid steel for closed cars.

No one until now ever succeeded in this and it was no simple task. It meant not only the drawing and forming of tough metal in unprecedentedly large sheets, but the designing even of the huge special presses to handle the steel.

Now, however, we are able to announce the complete success of this effort—in the new Fisher "Turret Top" closed bodies.

These bodies put over your head a safety armor of beautifully contoured solid steel, steel braced with steel like the modern battleship turret from which they take their name.

Even the steel roof is supported by steel-roof-bows and is welded to the other steel body panels.

Quiet, rugged, true, there is no rumble, drum or rattle—and you are protected from extreme seasonal heat and cold. Complete scientific insulation against *both* sound and temperature was achieved after years of work in the laboratory, testing on the open road, consultation with car owners and exhaustive experiments at the great General Motors Proving Ground.

And the traditional eye-satisfying beauty of Body by Fisher is actually enhanced by the smooth, flowing, uninterrupted line of this modern roof.

There are many other worthwhile improvements in Body by Fisher for 1935 too—such things as full streamlining, more luggage room, windstream V-type windshield, wider seats, more headroom, bigger doors—

And, of course, time-tested and owner-approved Fisher No Draft Ventilation—more highly perfected, more efficient, more expertly engineered than ever this year.

But the biggest improvement of all is the new Fisher solid steel "Turret Top"—now featured on the 1935 Chevrolets (Master De Luxe Series), Pontiacs and Oldsmobiles—and found, like Body by Fisher, *only* on General Motors cars.

THE *New* "TURRET TOP"

This is the way the new Fisher "Turret Top" looks—a single seamless sheet of tough drawn steel, steel reinforced with steel like a battleship turret. The "Turret Top" is better-looking, stronger, *safe* with the safety of solid steel. Equally important, there is no rumble, drum or rattle. After years of work and experiment we have developed a top that is not only insulated against sound, but that protects you from summer's heat and winter's cold as well

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CHEVROLET PONTIAC *Oldsmobile*

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POPULAR SCIENCE Monthly

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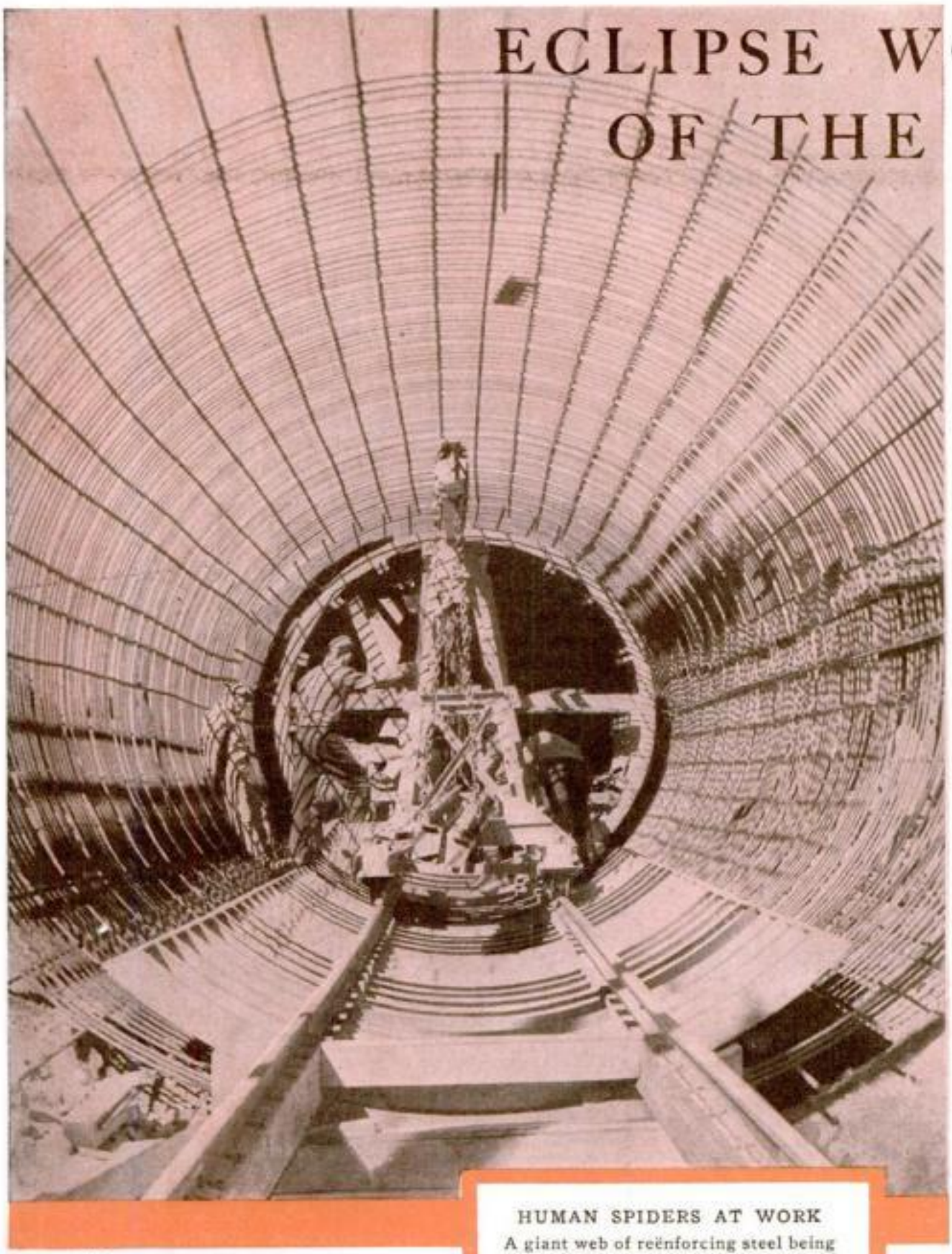
RAYMOND J. BROWN, Editor

Modern Engineering Feats

ECLIPSE WONDERS OF THE PAST



HUMAN SPIDERS AT WORK

A giant web of reënforcing steel being woven for a concrete siphon as part of a western water-supply project. The tube will be twelve feet in diameter

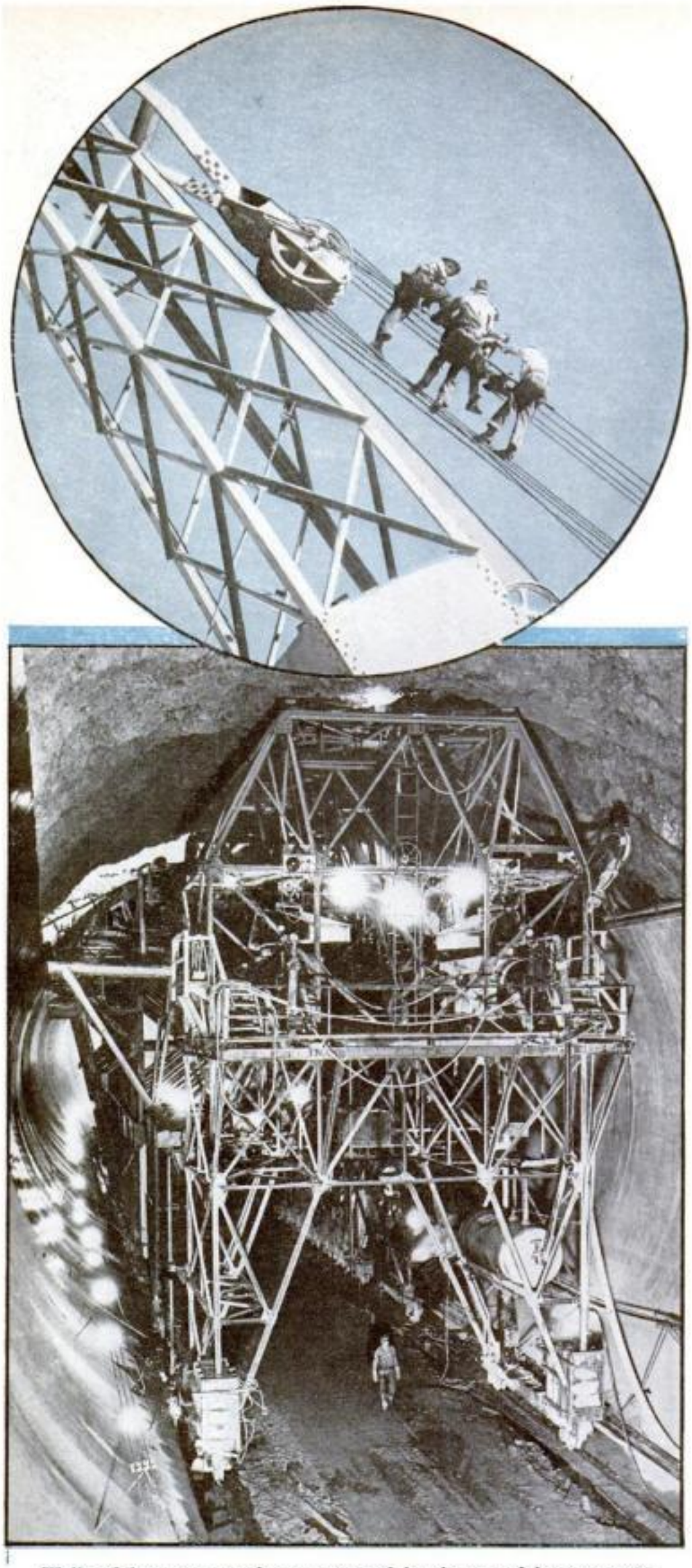
By STERLING GLEASON

A SECOND Age of Pyramids—that is what historians of the future may call the present era of colossal engineering works. Gigantic projects of a magnitude never before attempted are transforming the face of our country so that even now we can scarcely recognize it.

The Pharaohs of the present age already have undertaken jobs that shatter all precedents as Government billions are being put behind plans for vast public works. The world's greatest bridge is flinging a web of steel across the restless tides of the Golden Gate. The greatest dam of history soon will thrust its mighty bulwark of artificial stone against the turbulent, muddy Colorado. The longest aqueduct has begun to snake its way across nearly 200 miles of thirsty desert.

New plans include a grand four-lane transcontinental highway, avoiding all congested cities, landscaped and beautiful—a super-highway to match the racing speeds of today's automobiles; inland waterways to bring cargo-carrying vessels to newly created river ports; new tunnels and subways to relieve New York's congestion; sea walls to keep unruly ocean currents from cutting away our shore lines; and a nation-wide scrapping of tenements, which are to be replaced by modern homes utilizing modern methods of construction.

Behind these sensational projects lies a multitude of mechanical developments which have made possible astonishing miracles of engineering. Old forces are being put to



Walls of immense tunnels are cemented by the use of huge concrete gun carriages like the one shown above. In the circle at top of page, riggers are working on a mammoth crane on a construction job

Vast Public-Works Projects Are Transforming America With the Help of Amazing New Methods and Machines

new uses; new forces are being created to perform tasks that would have been impossible under former methods. In their relentless drive against natural obstacles, engineers are applying mechanical agencies in hitherto unheard-of ways.

Droning vibrators now rapidly agitate concrete as it is poured, causing it to settle compactly and to harden better and stronger.

Long explosive bombs are burrowing holes for foundations of the Golden Gate bridge at San Francisco, Calif.

Hydraulic "knives"—jets of water under tremendous pressure—magically slice away hillsides.

Robot bricklayers erect walls at three times the speed of human workers; concrete is shot from guns to create smooth surfaces of artificial stone; giant road-making machines now move almost with catlike tread because balloon tires and featherweight metals make them smoother and lighter.

Concrete, favorite building material of the modern age, is finding new usefulness through chemical magic. Chemists can now produce a concrete for any desired condition, by prescriptions which govern the nature and mixing of the ingredients. It can be made hard as stone, especially resistant to water, or light and porous. It can be made quick-drying, quick-setting, heat-insulating, or sound-absorbing.

Huge trucks with rotating churnlike bodies now speed to big jobs, mixing concrete as they go. Vibrating the mixture at high speed improves its quality, reduces honeycombing, makes it settle better, and saves cement. In big masses, as in huge dams, ordinary concrete would require years to harden completely; but new formulas and methods of curing reduce this time to a negligible period.

Where a siphon of the new Colorado River aqueduct goes over the crest of a mountain under the broiling desert sun, the outside of the concrete pipe is fifty degrees hotter than the inside. Artificial fog, applied to the concrete as it hardened, cured it so well that even under this terrific heat strain, it will not crack.

Completely cast in concrete, many new buildings are virtually monolithic, as if hewn out of a solid block of stone. Yet by spraying cement under high pressure onto plastic forms, which later can be removed, they may be beautifully ornamented with intricate designs, reproducing the finest work of artisans.

BRICK construction is speeded by a new device, turned by a crank, which spreads mortar so fast that one man can lay three times as many bricks as he could without it.

Just the moving of earth on a mammoth scale is another important phase of engineering advance. Huge bulldozers which by brute force simply nose big piles of earth ahead of them, shove new highways across the land. Enormous "buggies"—chariotlike steel carts, holding thirty cubic yards at a load—move earth in the building of the All-American canal on the lower Colorado River. Each "buggy" has great soft tires like balloons, almost as high as a man, and discharges its load at the rear without lifting.

A new one-man "bulldozer", gouging its way along the mountainside, gashes out a twelve-foot highway, by means of a special angle-blade.

The whole top of a western mountain began to melt away as engineers turned the nozzle of a powerful hydraulic gun on its summit. The mountain was slashed away to lower the grade 600 feet for a new road.

Seagoing tractors run on the ocean bed along the California coast. Dragging scrapers, they plunge into the surf and bring up sand to build a new link in an important highway. In another aquatic project, a huge grader with wide tires to traverse soft mud, circled round and round a submerged island in the center of a lake and reconstructed the entire shore line on a one-to-three slope to provide a smooth bathing beach.

Even the common machinery of big-scale construction has been transformed as modern engineering has made them more efficient. Gleaming new dump trucks have bodies made of aluminum to reduce the dead weight. Aluminum also lightens the booms of cranes and the buckets of steam shovels without reducing their strength.

Air-inflated rubber tires like those of automobiles appear on wheelbarrows, on tractors, on graders and road

machinery. Balloon tires, carrying forty pounds of air, were put on wheelbarrows to deliver concrete for a new building in Chicago. The barrows rolled along smoothly without jar and did not deface tile floors; they eliminated the need for planking. The strange sight of trucks driving into the U. S. Supreme Court Building was seen in Washington, D. C., the other day, as trucks drove up a ramp into the main entrance to unload marble and other heavy materials inside.

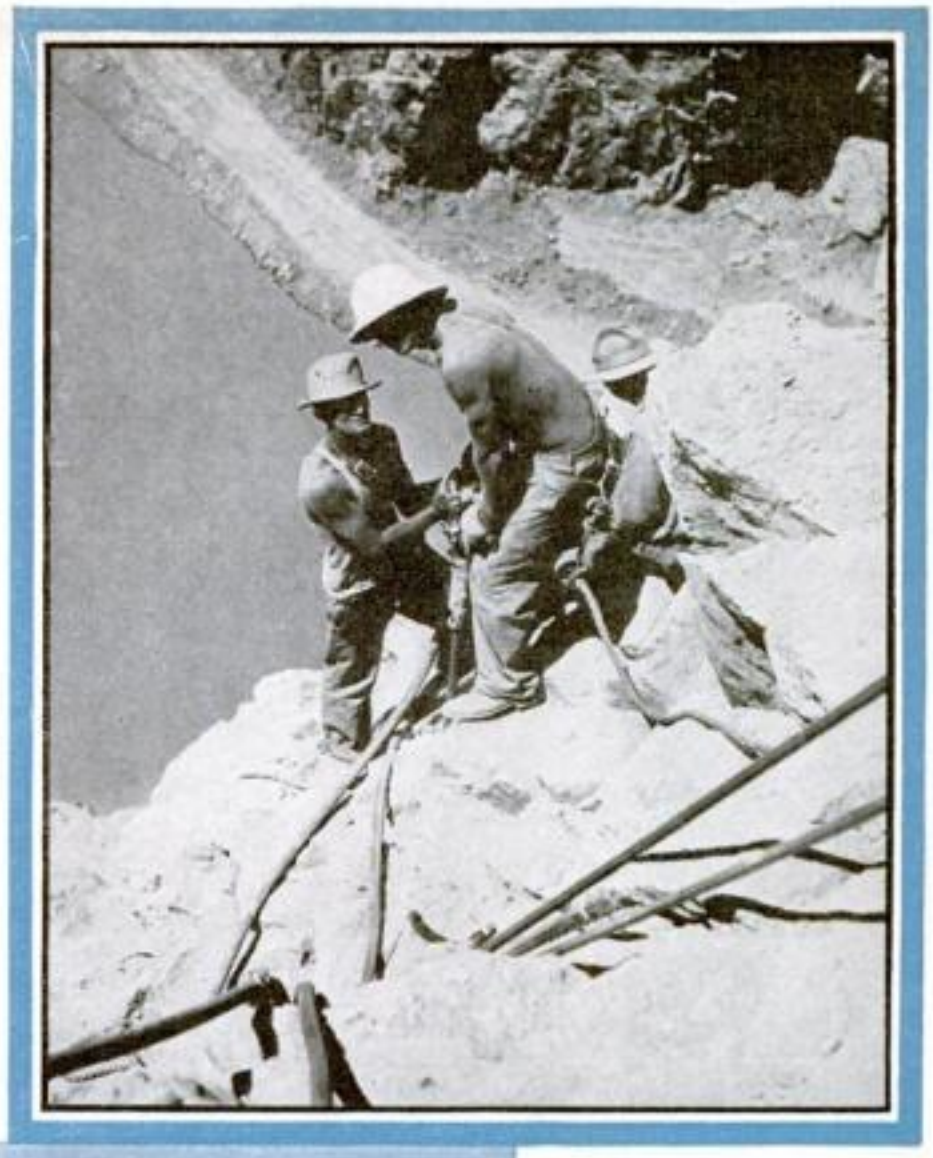
New metals from the laboratory are aiding in countless ways. A new aluminum, strong as steel but far lighter, forms a new skeleton for a fifty-one-year-old Pittsburgh bridge, removing 750 tons of dead weight from the old structure and extending its life an estimated twenty-five years. These tons are equal to the average weight of the traffic that will pass over it. Had the new aluminum been discovered sooner, it might have cut millions of dollars from the cost of the new Golden Gate Bridge, by making it lighter.

ALUMINUM-ALLOY bars in the hands of workmen lighten the work of stripping forms. Monel metal tubes in the Hoover Dam will forever defy rust and corrosion. X rays, too, have been drafted from the laboratory to aid big construction. To prevent flaws in welding of the huge steel penstocks, every joint was subjected to their invisible radiations. More than thirty-five miles of X-ray film were used in this inspection.

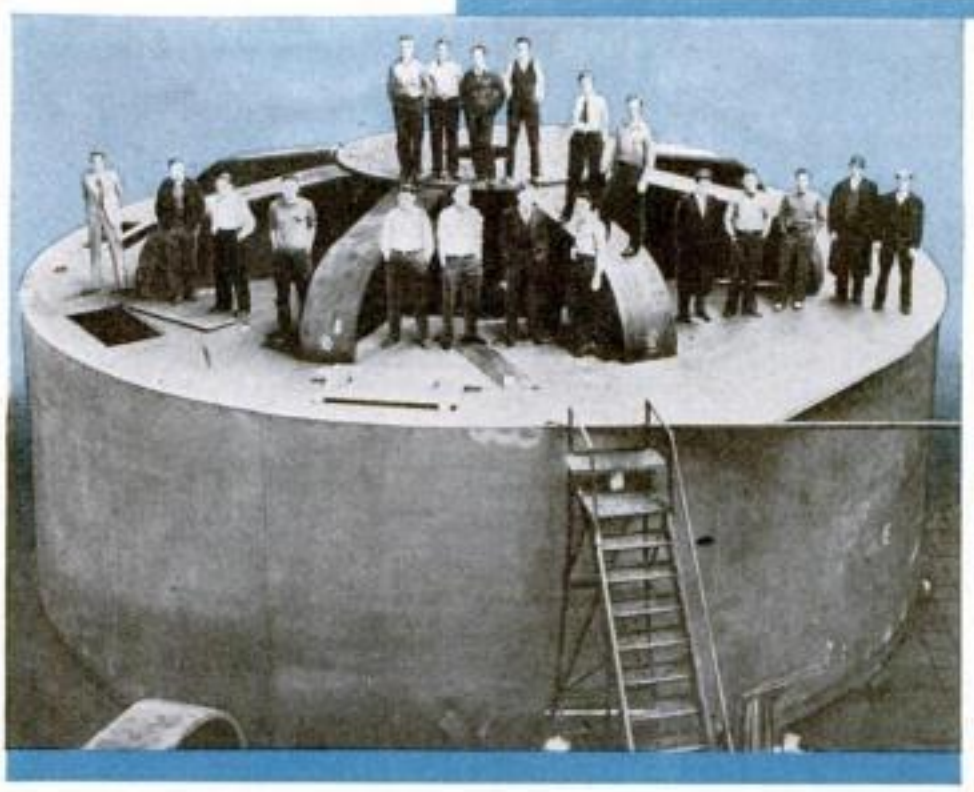
On bleak hills where the tunnels of the new Colorado River aqueduct are being forced through the mountains, thundering machines are automatically sharpening and tempering rock drills at so rapid a pace that they have already treated more drills than had ever before been sharpened in all engineering history, according to machinists.

In a large steel pipe line, it was found that the hot summer sun made temperatures inside unbearable to the welders who had to do their work inside. Coating the exterior with white paint reduced the temperature inside by fifteen or twenty degrees.

Workmen's lives are safeguarded by countless new safety devices. Men wear steel helmets like the war-time "tin hats" to protect their heads against falling rocks or rivets.



Pneumatic drills like this prepare the way for blasting away great masses of stone



The vast hydroelectric projects of today call for generators like the one shown above. Weighing 2,000,000 pounds, it had to be taken apart and sent to the dam site on a train of forty-five separate freight cars

The erection of power lines is speeded by mechanical post hole diggers. On this one, a rotating drill gouges out the holes in the manner of an auger

Safety goggles, heat-resisting clothing, and safety belts have their place. Scaffolding of steel prevents danger of falls in high construction work. Such a web of steel crept up the face of the Washington Monument recently when the huge shaft was given its first cleaning since its completion in 1884.

More than two miles of tubular scaffolding with solid planked runways six feet wide, blossomed over the whole surface of the J. W. Robinson store in Los Angeles, as workmen on sixteen levels gave the whole building a new face. Concrete, shot from guns at a pressure of 100 pounds to the square inch, formed a whole new exterior wall. Business went on as usual while special precautions prevented materials from falling on people coming and going in the streets below.

Life preservers in the form of safety vests are worn by all workmen on the piers of the San Francisco-Oakland bridge, to reduce danger of drowning in the rough waters of the bay below. To and from work, the steel erectors ride up and down on the high towers in elevators at a vertical speed of 100 feet a minute. The cages are enclosed by wire mesh to prevent accidents.

As air lines rapidly push on toward the bullet speed of 250 miles per hour, land transportation also moves faster. Cars traveling at racing *(Continued on page 106)*

MOTORSHIPS OF THE SILK

World's Greatest

FROM a New York silk dealer to a factor in Yokohama flashed this urgent cablegram the other day: "Rush 800 bales white silk next ship."

At the moment, there stood at a Yokohama dock the *Nagara Maru,* one of the newest members of the silk fleet, consisting of fifty fast motor freighters constructed during the last five years to speed delivery of Japan's silk to the United States. Her funnels belched smoke, as seven gangs, working with overhead slings and through ports, poured cargo into her holds.

An hour after the message reached the Japanese dealer in raw silk, two additional gangs were engaged in storing the valuable bales into the silk rooms, lined with steel and cork-dust walls and paneled in soft wood,—proof against water, fire, dust and vermin. In a few hours the last bale was braced atop soft-wood gratings and against the bulkheads; locks were snapped shut, and the speedy freighter turned her sharp prow eastward for a non-stop race of twelve days to Los Angeles, 4,839 miles away.

From Yokohama or Kobe, nearly every day, ships of the silk fleet sail, with their valuable and perishable cargo. They cross the Pacific more quickly than passenger liners, to Los Angeles, San Francisco, Portland, Seattle, and Vancouver; there, with a speed shown by no other international cargo-carriers, the silk is transferred to baggage cars attached to crack passenger trains for the final dash across the continent. Within sixteen days from the minute the doors slide closed on a silk cargo in Japan, it is in the hands of its American purchasers in New York or Chicago.

Until five years ago, most silk moved across the sea to the United States in freight and passenger steamers which often touched at several ports, on the way. Then the ship destined to be the forerunner of the scientifically constructed and fast motorships—the *Kanai Maru*—made her maiden trip from Yokohama to Los Angeles. She completed in eleven days a voyage that took most of her predecessors twenty-two days.

Then started the race to construct the "silk ships." They carry all manner of cargo, besides silk. They operate under the Japanese flag, for a half dozen leading Nipponese shipping firms. They have speed; they have excellent facilities for handling silk safely, and they have a long cruising range. Although the fleet now includes a half hundred vessels, even more ships are on the ways, and in a few months will join in the silk race.

The newest ships to join the fleet are the *Nagara Maru, Noto Maru, Nako Maru, Noshiro Maru, Naruto Maru* and the *Nojima Maru.* Each vessel displaces 9,000 tons, and can cross the Pacific in eleven days. In early trials they attained a speed of eighteen and one half knots. To aid in achieving speed, each has a compact bridge amidships, with detached forecastle, bridge, and poop decks, a cruiser stern and a streamlined, balanced rudder. All the vessels are propelled by seven-cylinder Diesel engines.

These new ocean carriers are said to be the safest ever to transport cargo. They were completed and equipped according to international specifications laid down by the Japanese, British and American insurance and government bodies. A cellular double bottom for fuel oil and ballast water is carried throughout the length of each. The hull is subdivided by eight water-tight bulkheads. All of the engine-room auxiliary apparatus and deck machinery is electrically driven.

The silk rooms are in a hold immediately aft of the bridge. Chance of damage or destruction is minimized by minute precautions, from steel hatch covers, to a smoke-detection panel at which an officer stands guard constantly. Air is drawn from all holds through small-bore pipes and carried to the smoke-detecting cabinet in the wheelhouse. By merely turning a lever, the officer on watch can shoot carbon dioxide gas, through the same pipes, to the place of an outbreak.

In the designing of few ships have such efforts as these been expended to speed the vessel through heavy seas, and to facilitate loading and unloading, also. When a cargo of, possibly, 8,000 bales of silk is added to a heavy load of general merchandise, as many as nine gangs pour raw and manufactured goods into her

In the photograph above, silkworms are seen feeding on mulberry leaves. Right, women sorting the cocoons before they are boiled. Boiling softens filaments so they can be drawn easily into threads

FIFTY fast freighters ply the Pacific at express speed with precious cargoes from Japan to help American manufacturers meet the growing demand for silk products

By ANDREW R. BOONE

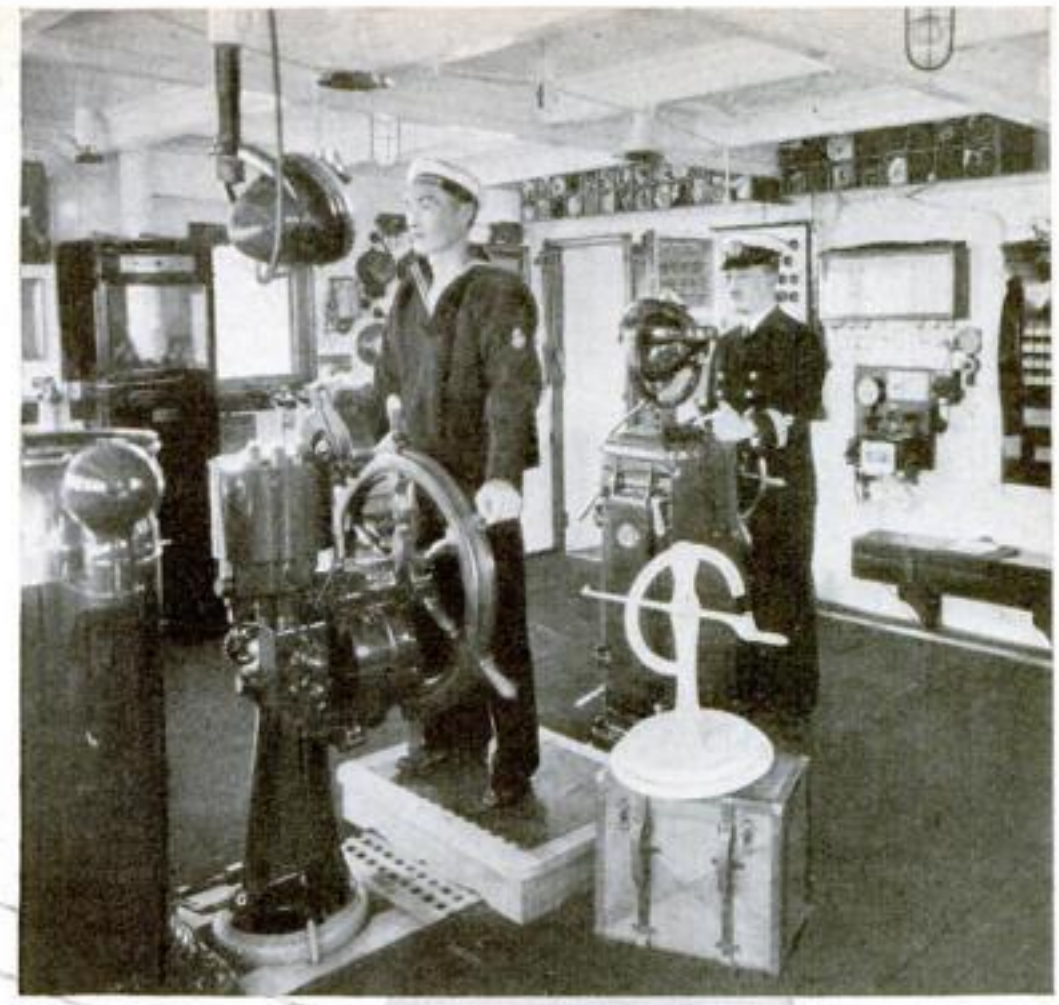
Map shows the path of raw silk in its race from Japan to factories on the

FLEET SAIL
Sea Race

holds, seven from the wharf and two from lighters drawn alongside. Nor does the fast pace slacken when a silk ship reaches an American port. An electric warping winch aids in hauling the vessel into the dock. Eighteen cargo derricks help in unloading quickly. Special cars stand ready to receive the silk.

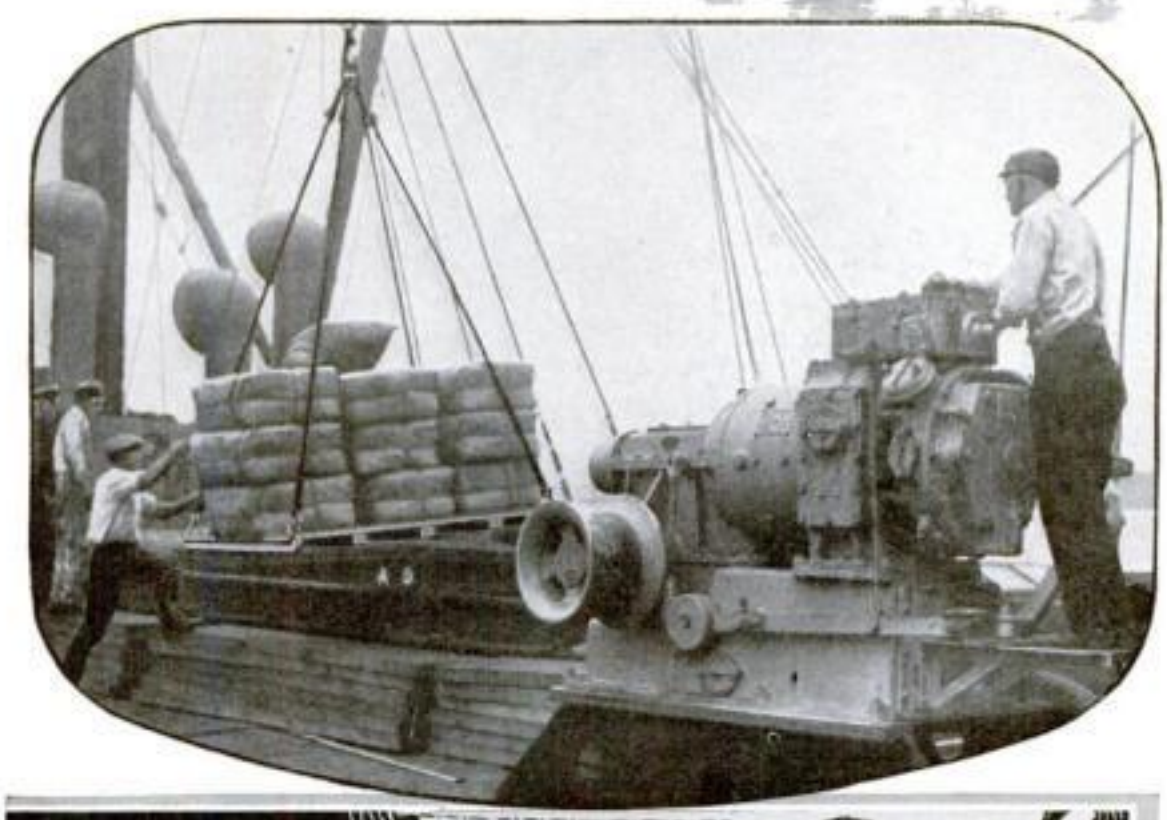
Although silk moves silently across ocean and continent, a far-flung organization speeds it on its way. Suppose we follow the route:

Recently the *Nagara Maru* wirelessed her shore representatives at Los Angeles she would dock at eight on the morning of the second day to discharge 200 bales. A traffic clerk telephoned the information to a railway agent. Telegraph instruments began to sputter. The superintendent at San Francisco was informed of the movement; the dispatcher at Los Angeles received the message; a vice-president at San Francisco read the message and arranged an insurance policy; the superintendent of transportation scrutinized a copy and arranged uninterrupted service to Chicago; special agents—railway detectives—from Los Angeles to New York, read the message and prepared to be on hand when the sealed shipment passed through their towns; an attorney for the railroad visited a customs office and obtained an advance permit for the valuable bales to move through customs without delay.



Picture at top shows the bridge of one of the silk ships. Above, the *Nagara Maru*, a recent addition to the Japanese silk fleet

Below, an electric winch lifts precious bales from the special silk room of a Japanese freighter



other side of the earth. Fast ships and express trains beat ordinary passenger schedules

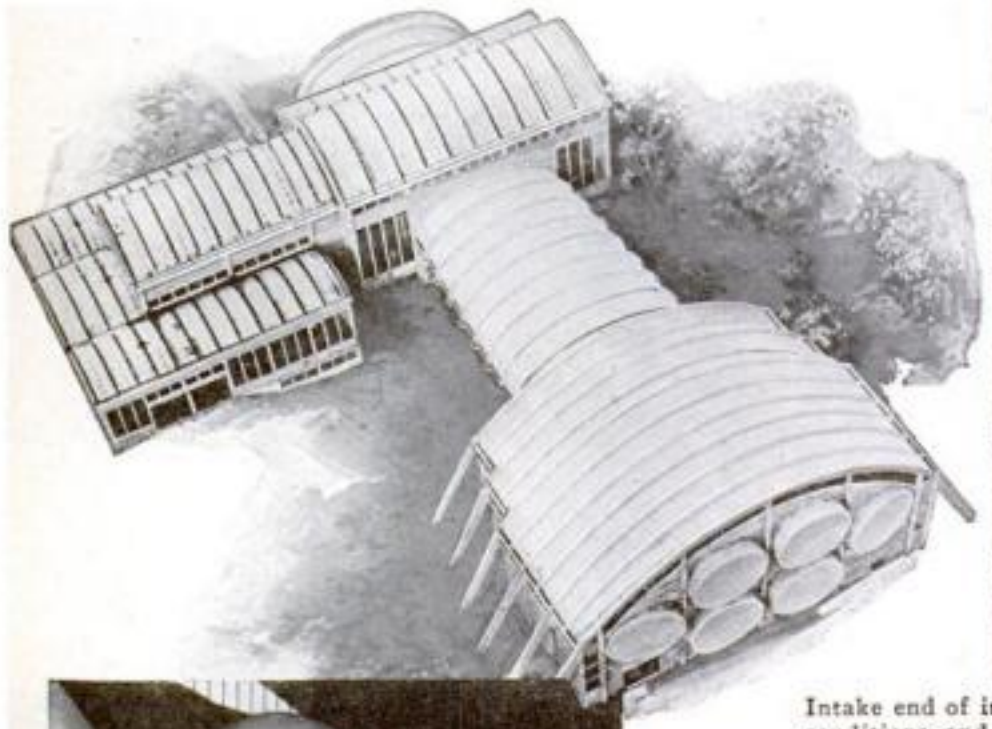
Meantime, workmen inspected the baggage car, because it must be mechanically perfect. They pulled out all protruding splinters, papered all windows to hide the bales from curious eyes, and to make the car dust-proof. When the car reached the dock side, engineers inspected it a second time and tested the brakes to make sure the car would reach New York without breaking down.

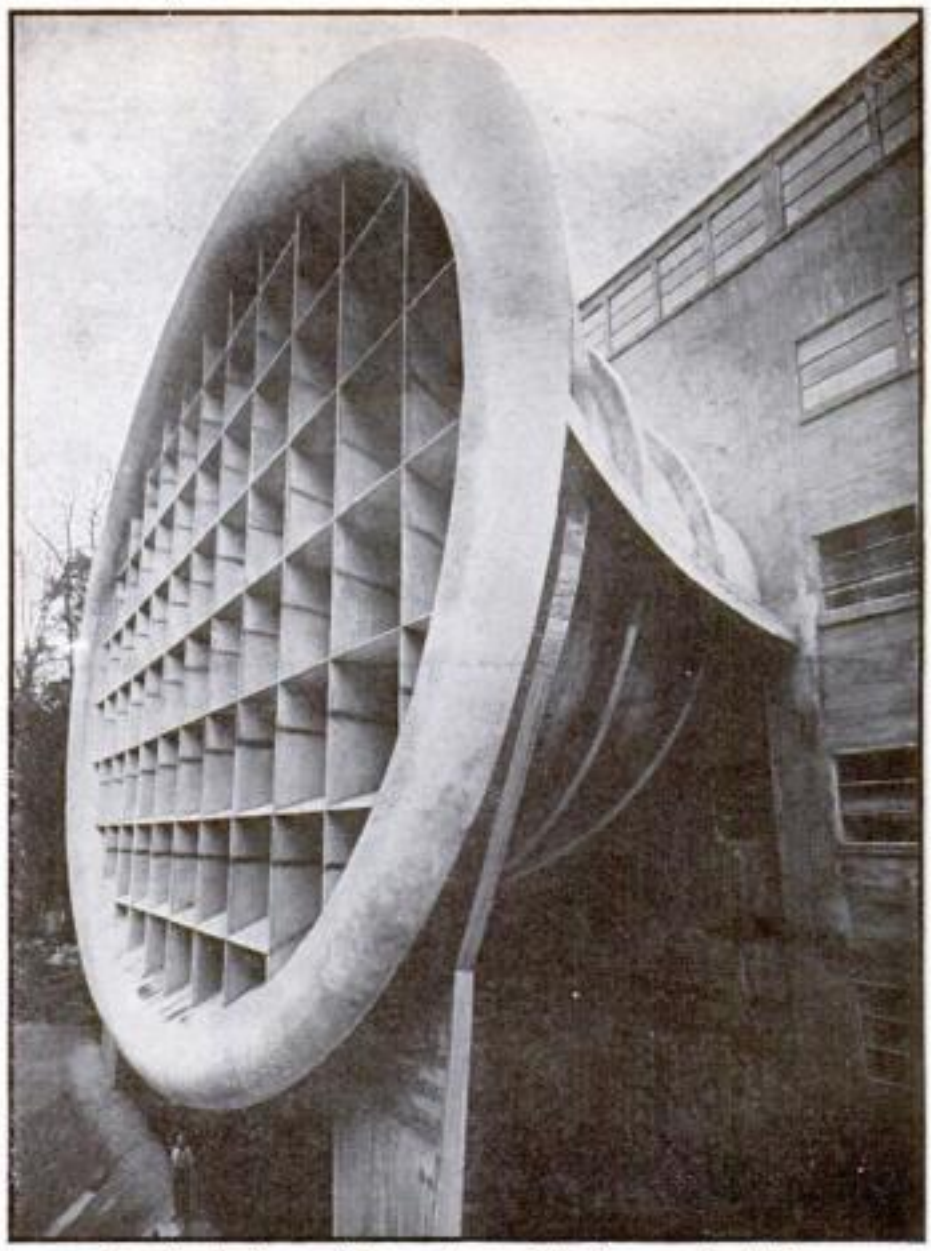
As the ship warped into the dock, stevedores poured aboard. A few minutes later, electric motors began to lift the 140-pound bales from the silk rooms and to lower them on to the wharf. The customs attorney watched over the transfer from ship to wharf. An officer wearing the insignia of Uncle Sam's customs service—guarding against possible smuggling—periodically broke open a bale and examined its contents.

Other hands deftly sewed up the cotton-lined rattan bales. An officer released them to the railroad. Workers, pushing two-wheel trucks, rolled the bales into the car. An inspector, having checked the cargo, ordered the car closed and locked. An electric engine, standing ready, eased the car off the side track to the main line *(Continued on page 105)*

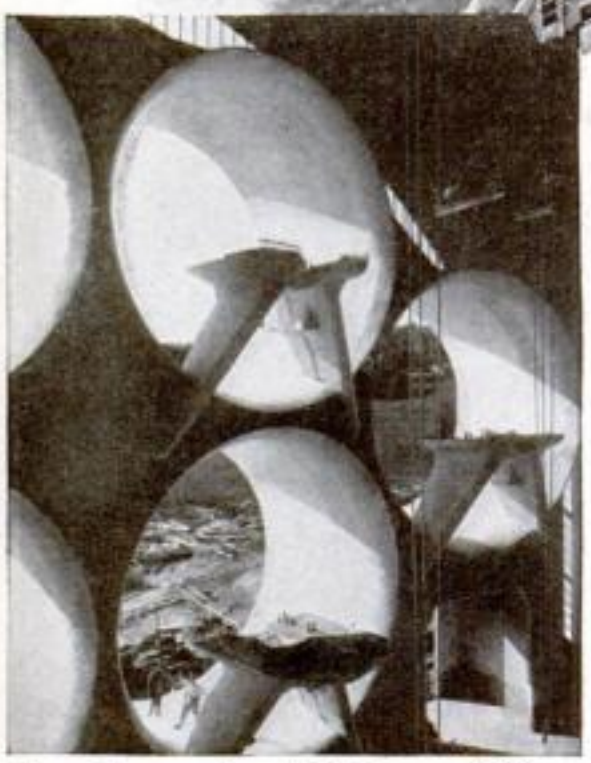
Hurricane Tunnel To Test Real Airplanes

A DOZEN men standing on each other's shoulders would barely reach across the intake of an immense wind tunnel now nearing completion in France. At the opposite side of the testing station, a battery of round openings expels the air. Half a dozen huge propellers will pull a hurricane through the big tube when it is completed, enabling engineers to study the behavior of full-sized planes under actual high-speed flight conditions. Whereas most wind-tunnel experiments are conducted with models, the new French plant will test actual planes.





Intake end of immense French wind tunnel for testing real airplanes under flight conditions, and, at left, testing station from the air, showing general arrangement



Cheeselike openings in discharge end of tunnel, behind which giant propellers will whirl

TESTS SHOW HOW BABIES LEARN

How babies learn is being studied by New York psychologists, who have taught one fifteen-months-old girl to climb a steep incline, leap fearlessly from a high platform into her instructor's arms, use roller skates, and play memory games. Her twin sister, without this special training, resembles an average infant. If a baby suddenly loses a newly acquired ability, one of the psychologists' conclusions shows, parents need not worry; the lapse, usually temporary, is a normal result of the excitement of learning other new things. These experiments give psychologists a direct approach to the age-old problem of the relative importance of heredity and environment.

This fifteen-months-old girl, who has been specially trained by scientists, climbs steep incline unaided

TRACTOR PULLS AFRICAN HAY TRAIN

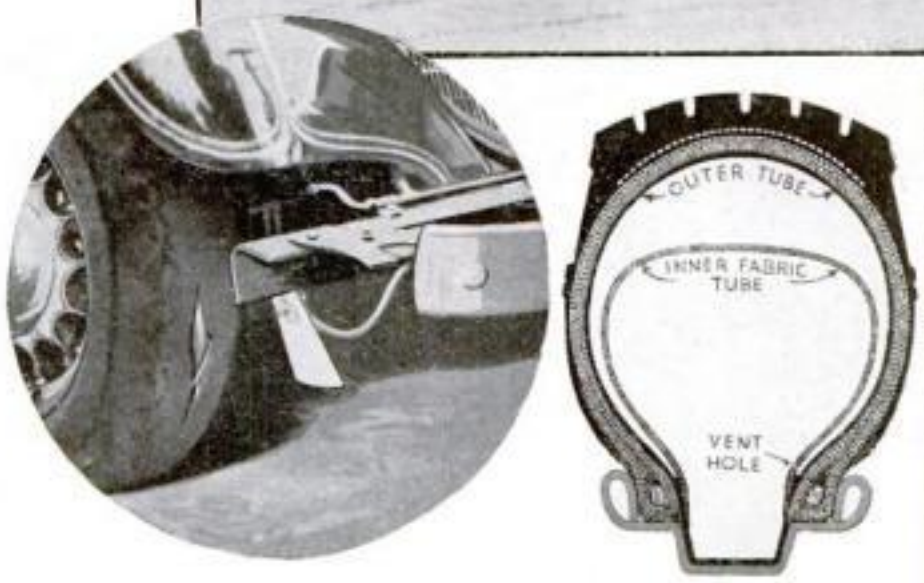
DRIVEN by steam, a curious tractor, built by a British firm, has just been placed in service in Rhodesia, to haul a train of six trailers laden with hay. Gasoline serves as fuel for the steam boiler, and the fuel tank constitutes almost the entire body of the truck, because the tropical country is wild and sparsely settled and refueling stations are a long way apart. The appearance of the odd tractor is shown in the picture at the right; below, the train that it pulls.

Safety Tube Ends Blowout Peril

STRAIGHT toward a board studded with six-inch spikes, laid in its path, raced a sedan at fifty miles an hour. With two sharp reports, the left front and rear tires blew out—such a mishap as might ordinarily occur only in a motorist's nightmare. But the car did not swerve. Its occupants felt no jolt. Instead, the machine with the shattered tires coasted to a safe and easy stop as the driver leisurely slackened power and applied the brakes. The tire tracks on the snow-covered, slippery runway of Floyd Bennett Airport, New York, where the spectacular demonstration was staged the other day, might have been drawn with a ruler for their straightness.

Speeding at fifty miles an hour, a test car heads for a spike-studded board to try safety tubes for blowout protection

The occasion was the first public demonstration of the latest advance in auto safety—a tire tube that can undergo a real blowout without throwing the car out of control and imperiling its riders. The tube consists of an inner and outer air chamber, interconnected by a single tiny vent hole. When the outer chamber is pierced and its air escapes, the weight of the car simply drops upon the inner chamber. This chamber loses its air very slowly through the vent hole, virtually transforming a blowout into a slow leak and giving a driver ample time to bring his car to a stop before the tire goes completely flat.



In circle is an electrically tripped knife that slashes tires in tests. Drawing shows construction of safety tube. Right, a tire cut open after a blowout, revealing the tube

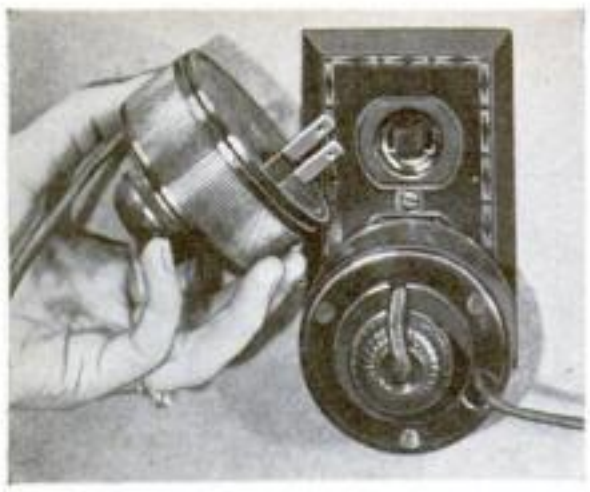
This has been demonstrated by engineers who have deliberately blown out hundreds of the tubes at high speed, both riding over spikes and by slashing the tires with an electrically tripped knife on the bumper of the test car. Even if a spike is driven far enough into the tire to strike the inner safety chamber, the resiliency of the latter, which normally "floats" under no strain, allows it to be pushed inward and not punctured.

EXPERIMENTER DRINKS "HEAVY WATER" AT $5,000 A QUART

A scene in the laboratory where Prof. Klaus Hansen produces "heavy water." The picture at the right proves that this strange substance weighs more than ordinary water. The quantity in the left-hand graduate is worth $50

RISKING his life to satisfy his curiosity about "heavy water," Prof. Klaus Hansen, Norwegian scientist, recently tipped a small glassful to his lips and drank it. Attendants stood by with stomach pumps and heart stimulants, since no one knew whether the mysterious substance was harmless or deadly poison to human beings. But the bold experimenter reported no ill effects beyond a mild shock and burning lips. Now he plans to take an increasing dose daily to test its effect. "Heavy water," discovered in America in 1931, exists in traces in ordinary water, and can be isolated by electrical and other means at a cost of $5,000 a quart. It weighs one-tenth again as much as ordinary water, freezes at a temperature nine degrees higher, and boils at a temperature three degrees higher. Its effect on living things, however, is still uncertain. The suggestion has been advanced that heavy water, accumulating in human tissues, might cause symptoms of old age.

Prof. Hansen takes the daring step of drinking "heavy water," not knowing how it might affect him. He plans to take an increasing amount of it each day



REEL KEEPS CORD TAUT

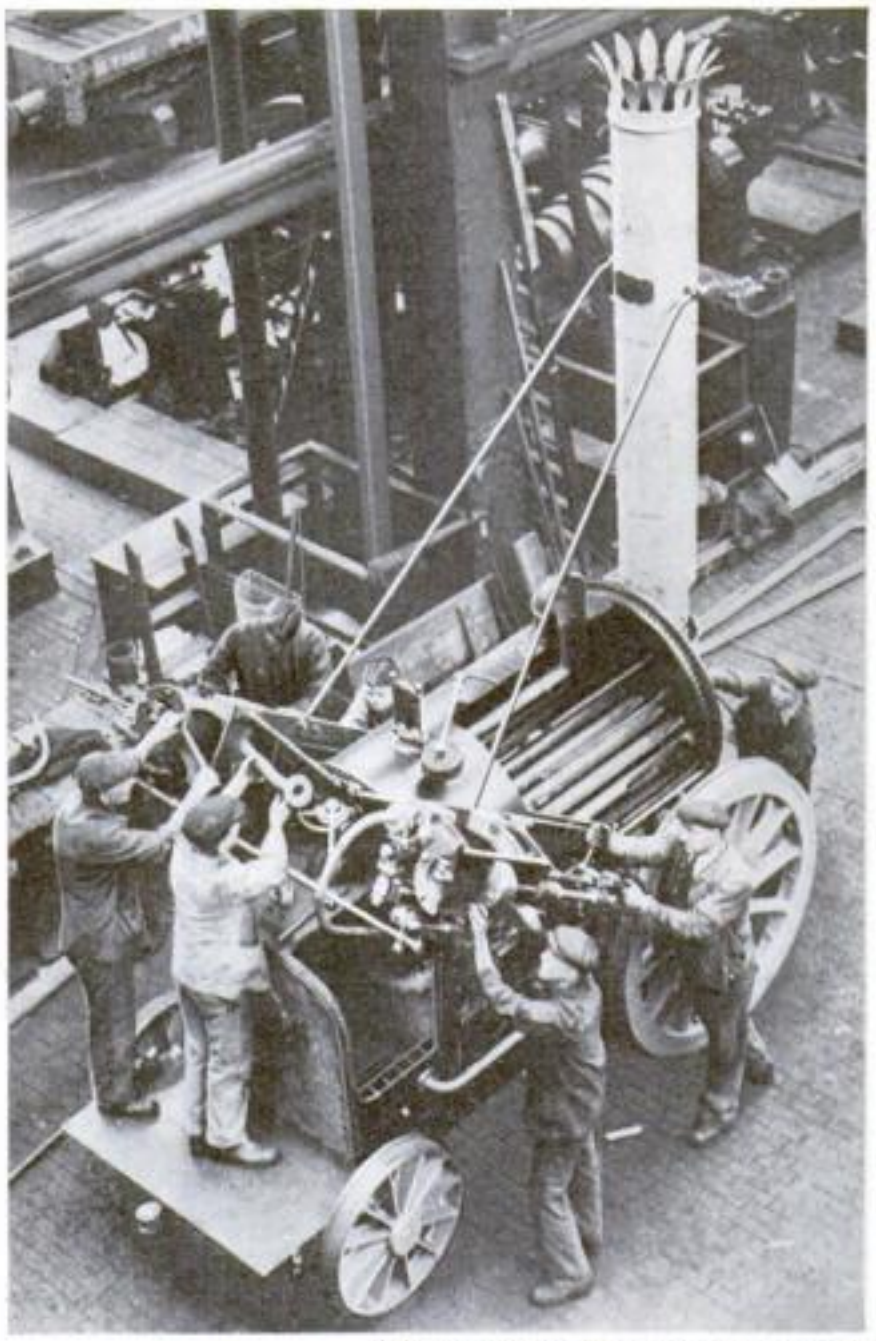
UNSIGHTLY lengths of electric cord trailing on the floor are obviated by the use of new wind-up reels. When a reel is plugged into an outlet and the cord has been attached and looped through a take-up slot, the slack is drawn in by turning the rim of the reel. Two reels can be attached to a standard double outlet, as shown above.

AVIATORS FEED BIRDS

TWENTY thousand pounds of grain fell from the air recently over seven New Jersey counties, when eighteen planes participated in a bird-feeding program sponsored by a state sportsmen's association.

EARLY STEAM LOCOMOTIVE REPRODUCED

IN THE Stephenson locomotive foundry at Darlington, England, the other day, workmen laid aside the task of building mighty modern engines to recreate a pioneer of the past. The odd order they filled was one from the Kensington Museum for a copy of George Stephenson's famous *Rocket*, built in 1829. The picture shows the historic exhibit nearing completion. But for the incongruous environment of twentieth-century machines, it might not have been hard for the workmen to imagine themselves making ready the original *Rocket* for the trial, before skeptical railroad directors, that was destined to make transportation history.

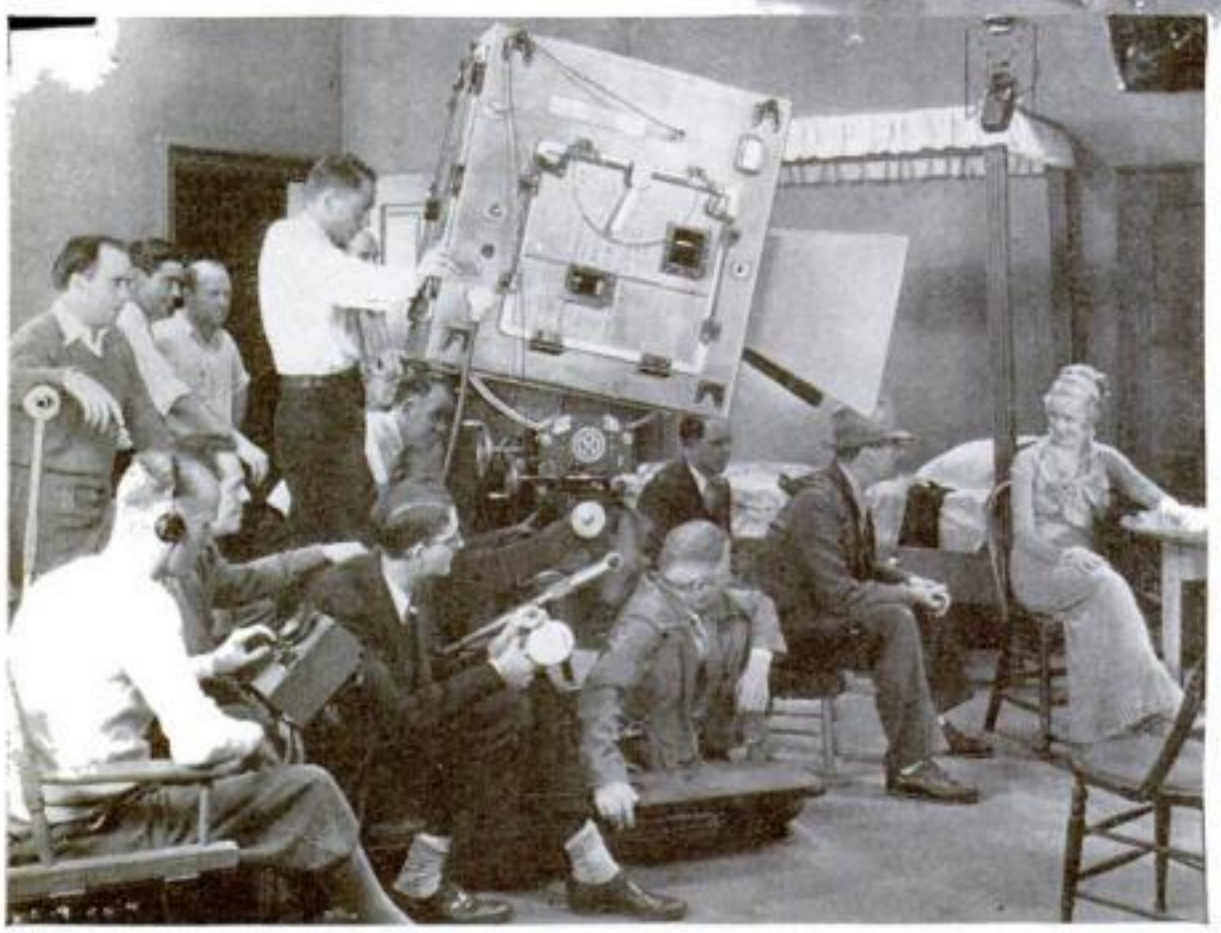


Workmen of the Stephenson locomotive foundry at Darlington, England, assembling a reproduction of the famous *Rocket* built by George Stephenson back in 1829

TOOLS PICTURES ON LEATHER

CREATING pictures on leather is the odd hobby of a Lubbock, Tex., dentist. Cowboys on broncos, knights in armor, and wild animals in their native haunts are among the subjects drawn upon for his novel craft. His first step is to make a freehand design on brown wrapping paper, transferring it with tracing tools to dampened saddle leather. The design is then cut through the first layer of leather. Hand tooling, with homemade tools fashioned from broken dental instruments, completes the design. To set off the figures, the artist dyes the background black.

Dr. W. A. Maddox, of Lubbock, Tex., at work on one of his unusual pictures on leather. He uses dental instruments



FOUR-MAN CAMERA TAKES MOVIES IN COLORS

COLOR movies that rival the hues of nature, made with a new camera that requires a crew of four men to operate it, are soon to make their debut before theatergoers. The camera, shown in use at left, exposes three films simultaneously, using one to record each of the three primary colors in a scene. A novel optical system, including a mirror flecked with gold, separates the color rays for distribution to the films. After development, a single combined positive is made, which is in natural colors and may be exhibited in an ordinary theater projector. The new process is said to give delicate gradations of color beyond the reach of two-color processes in which only a single color separation is made. It also avoids the color fringes seen at the edge of rapidly moving objects in some earlier processes when a single film is used to record the various primary colors. Color movies made by the new system will be introduced in the production, "Becky Sharp," a screen version of "Vanity Fair."

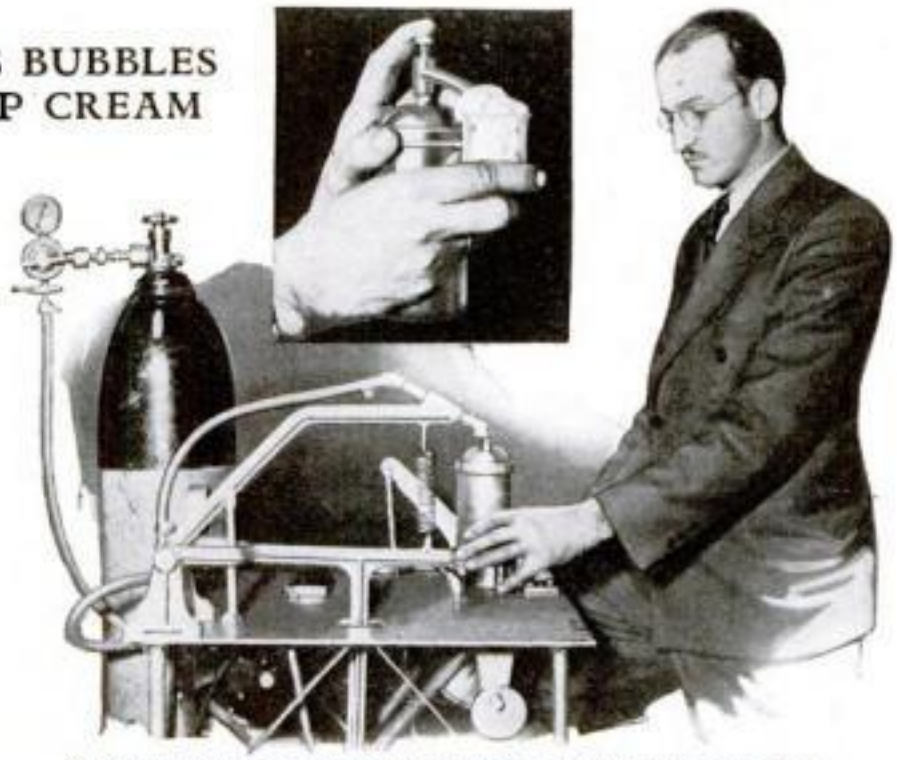
Aztec Temple Found Under Mexico City

ANCIENT and modern cultures met unexpectedly when excavators, preparing a foundation for a municipal improvement in the heart of Mexico City, recently struck an Aztec temple only a few feet underground. The ruin had lain buried for 800 years within a block of the National Palace while none suspected its existence. Plans for the civic work were halted abruptly, and archaeologists set to work at gingerly clearing the overlying debris from relics that may tell them much about the former inhabitants of the site. Elaborate carvings of serpents and other ferocious-looking objects were found in perfect condition.

Where Aztec ruins were discovered, near National Palace, shown in background. Left, two stone dragons' heads, temple ornaments

LAUGHING-GAS BUBBLES MADE TO WHIP CREAM

THE "bubble method" for whipping cream has now been perfected by Charles A. Getz, University of Illinois chemist, after preliminary experiments described in an earlier issue. Ordinary cream is put up by the dairy in airtight containers of automobile steel, resembling soda siphons; and nitrous oxide, an inert gas, is then injected. When the housewife presses a button on top of the container, bubbles of gas whip the cream and deliver it for use.



How housewife serves cream by pushing button is shown above. In larger picture, chemist injecting gas into cream container

SNOW PLOW CLEANS WALK

A BABY rotary snowplow, a miniature version of the type that railroads use, has aided its Oregon inventor in keeping his sidewalk clear. A small gasoline engine drives whirling blades that throw the bulk of the snow to the side, as the operator pushes the machine along. The device made only a few minutes' work of the sidewalk shown below.

Oregon inventor and his rotary snowplow for sidewalk use. Note stretch of clear pavement

NURSE USES TINY LAMP

A NEW type of flashlight bulb, no larger than a kernel of corn, has permitted the manufacture of a practical flashlight declared smaller than anything of its kind hitherto made. Resembling a small fountain pen, the flashlight is a convenient handbag or vest pocket accessory, and offers a convenience to doctors and nurses as well as laymen because of its compactness. Left, a nurse using it. Inset, the bulb itself.

Racing Drivers Lead

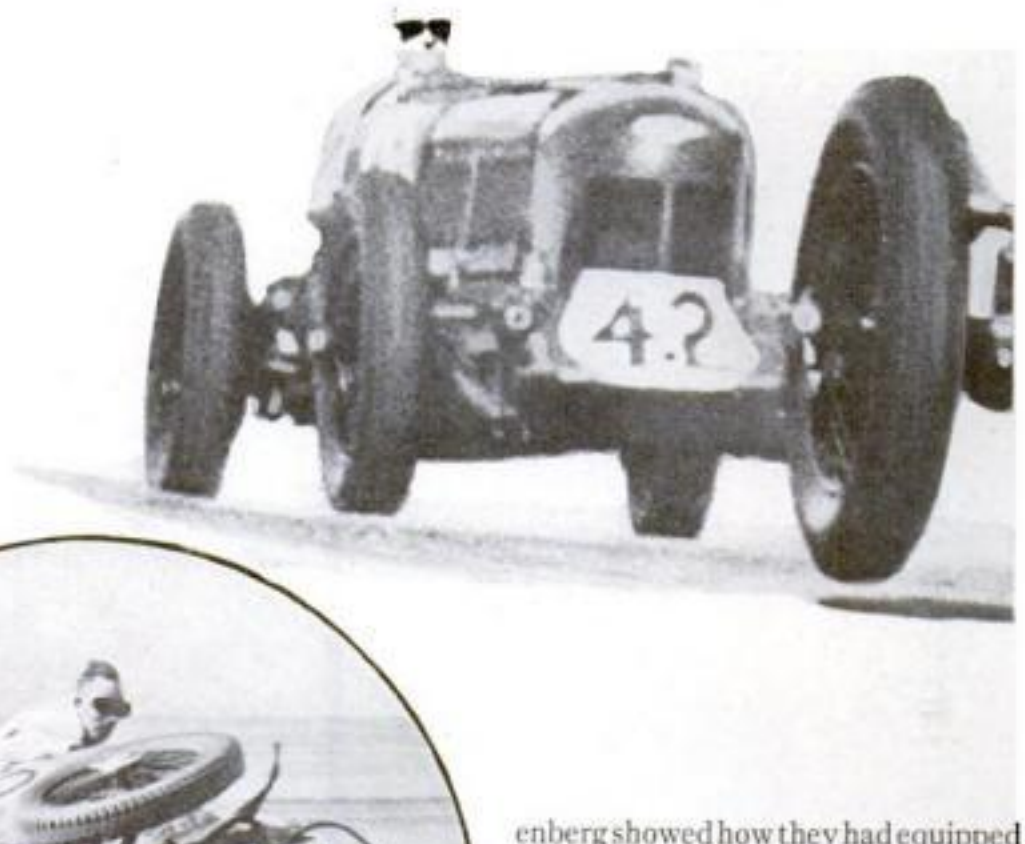
FROM THE ROARING ROAD COME NEW DEVELOPMENTS FOR COMFORT AND SAFETY

SOME people call automobile race drivers reckless fools. But one of the most famous of all the speedway clan, gray-haired Ralph DePalma, who has survived well over twenty years of big-time racing, calls himself and his rivals "the guinea pigs of the automobile industry."

The race drivers try out almost every innovation that results in increased motoring safety and comfort for the ordinary car user. If it were not for them, we wouldn't be driving 1940-model cars in 1935. In other words, our new cars of today wouldn't be any faster, any more comfortable, any more dependable, or any more economical than were the cars of 1930. From a few hours of the terrific strain of racing, engineers and manufacturers can find out more about the real value of new features of engine design, car balance, ignition, or tire construction than they could learn from months of laboratory experiments and road testing.

As a general thing, a new development that proves its worth in racing will show up as a selling point in some manufacturer's production car within four or five years. Sometimes the manufacturers lag much farther than that behind the speedway drivers. It was that way with four-wheel brakes.

Back in 1915, spectators at the Elgin (Ill.) National Trophy Race were astonished at the ease with which some of the drivers took the square turns of the dirt-road course after running up to them at a speed of eighty miles an hour. They saw that these pilots were all members of the racing team driving Duesenberg cars. After the race, Fred and "Augie" Duesenberg showed how they had equipped their cars with front-wheel brakes in addition to the usual brakes on the rear wheels. After that, all American racing cars used four-wheel brakes. But it wasn't until 1923 that they were introduced on passenger cars.



Wrecks like this do more than thrill the speedway spectators. They reveal flaws in production-car engineering work

A tense moment in a Vanderbilt Cup race. This classic of the early days of racing taught manufacturers many things about the building of automobiles. Road races have special value as tests, simulating conditions of highway driving

Independently sprung (knee-action) wheels took even longer to make the journey from the race track to the highway. They have been used on European racing cars for many years, and, away back in 1910, Ralph DePalma had them on a car that he raced on Long Island.

It was much the same way with the eight-cylinders-in-line engine. In 1905, Arthur MacDonald, a Britisher, drove a straight-eight Napier at 104.65 miles an hour on the Ormond-Daytona Beach course in Florida. That same year, Ford and Franklin built straight-eight racing cars. The next winter, Demogeot, a Frenchman, piloted a straight-eight Darracq over the Florida course at more than two-miles-a-minute speed. Then there was a lapse of several years before Fred Duesenberg brought out another straight-eight racer. Something like twenty years after its first appearance in racing, the eight-in-line engine became common in production cars.

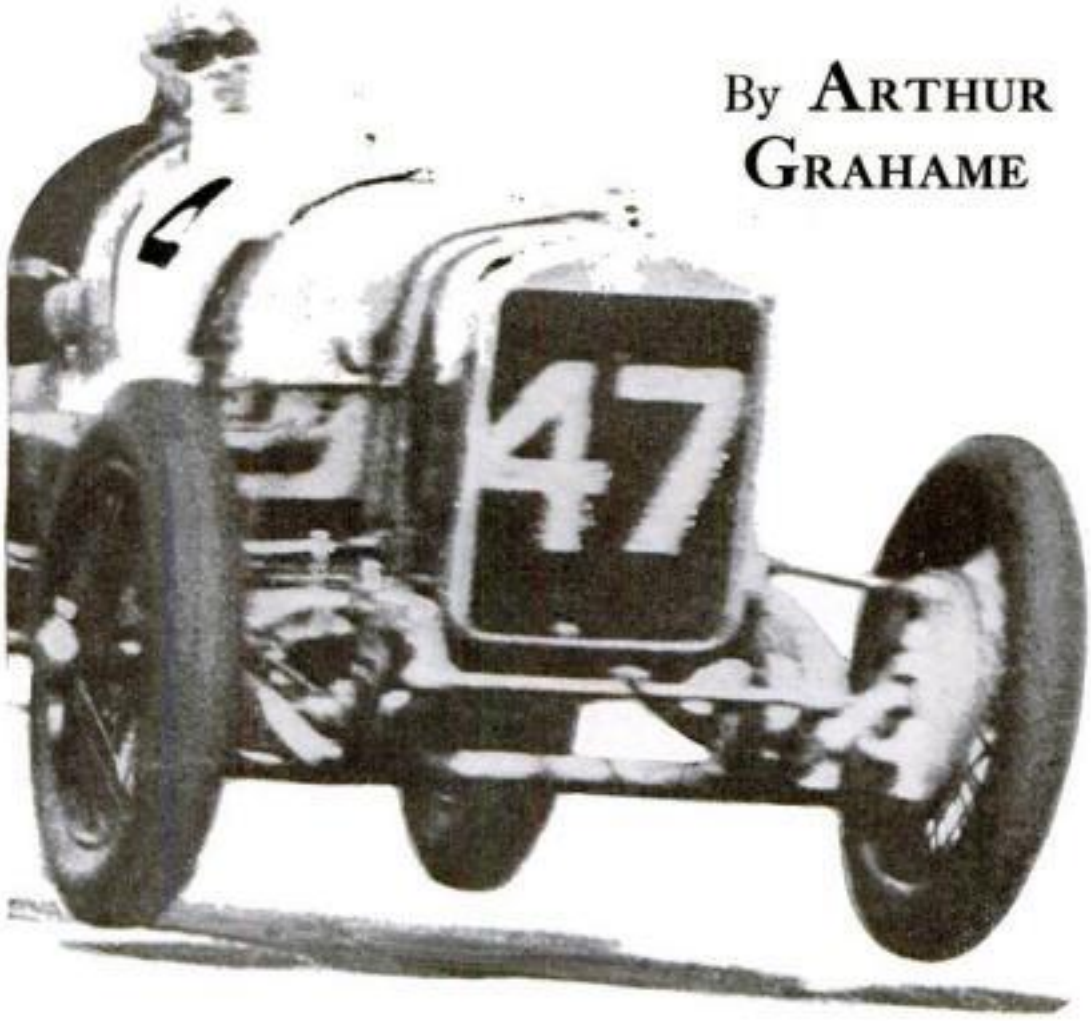
As for streamlining—back in 1904 the Stanley Steamer, the first car to reach two-miles-a-minute speed, was as thoroughly streamlined as is Sir Malcolm Campbell's new *Bluebird* which he expects to drive five miles a minute.

Many of the less spectacular improvements that have made driving safe and comfortable also have come from the speedways. Nowadays, you buy a car, drive it 40,000 miles, and turn it in for a new one without ever having had to think of valve trouble. It wasn't always that way, as you will remember, if you have been driving for ten or fifteen years. The improvement can be traced directly to racing experience.

One day in 1926, Frank Elliott, then a prominent

the Way to Better Cars

By ARTHUR GRAHAME



speedway driver, held a big lead in an important race. He had only twenty-eight laps to go, and as he streaked around the track he planned how he was going to spend the winner's end of the purse. Then a valve spring broke, and put him out of the running.

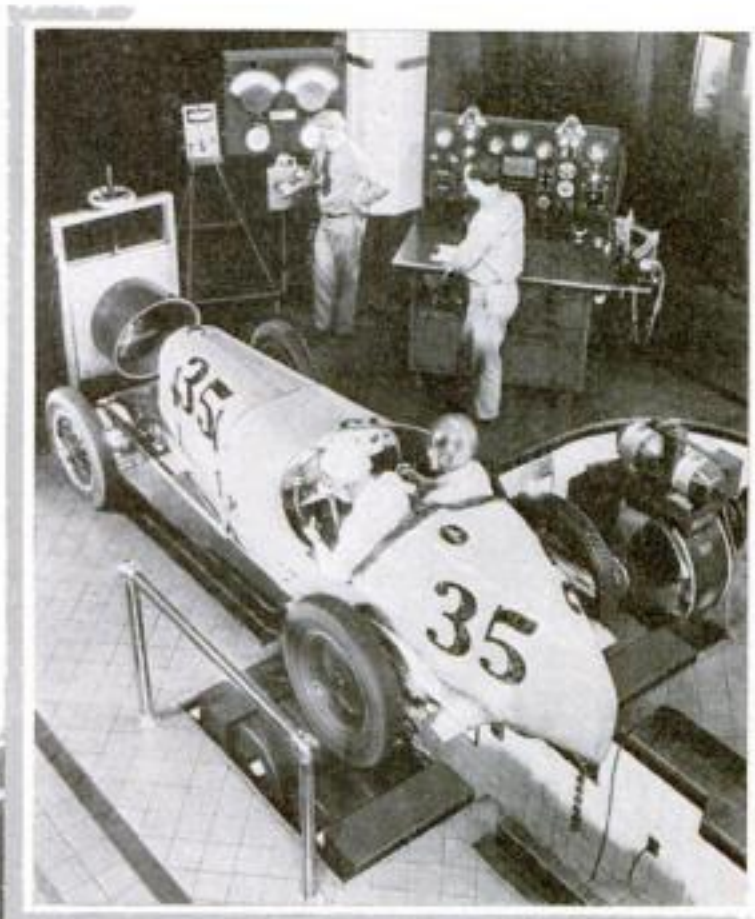
Elliott cursed his luck. But he didn't stop at cursing. He got after the manufacturers of valve springs. On his insistence, they experimented; he tested the results. Finally they changed the design and materials that produced the almost trouble-proof valves of today.

ON THE Indianapolis Speedway last Memorial Day, Bill Cummings, the present national champion, won the blue-ribbon event of American automobile racing, the annual 500-mile International Sweepstakes—with an average speed of 104.86 miles per hour. But what interested the automobile industry in this race was the fact that Cummings had used a newly developed fuel, not yet on the market, and that he had burned up only thirty-five and a half gallons of it in nearly five hours of 104-miles-per-hour driving. An average of 14.1 miles per gallon of gasoline in a specialized racing car! A consumption of less than a half pound of fuel per horsepower hour—better than is claimed by the manufacturers of the most efficient aviation engines! These were test results that were highly important to the industry, and promise savings of hundreds of thousands of dollars a year to ordinary motorists in the near future.

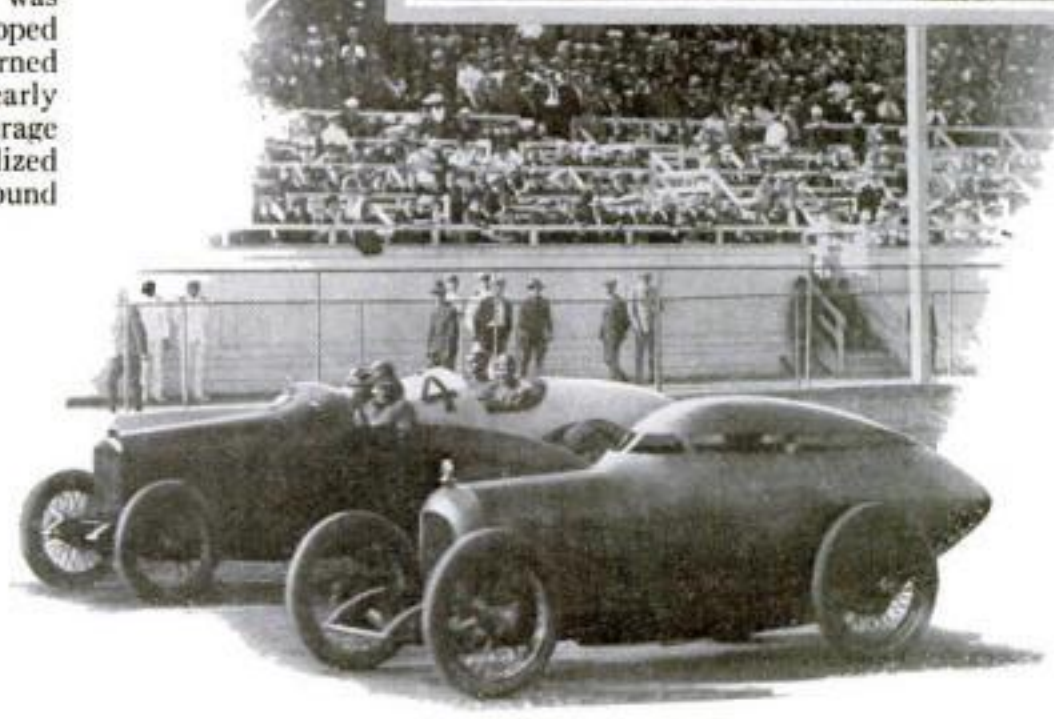
Each July, automobile racing men—engineers, designers and manufacturers—meet at the invitation of the Contest Board of the American Automobile Association to frame the entry conditions of the next year's Indianapolis race so as to encourage development along useful and practical lines, and to test out results of research work. When the conditions for the 1934 race were discussed, it was found that greater fuel economy was one of the main objectives of the industry, and to encourage the development of fuels that would give this desired economy a fuel limit of forty-five gallons was adopted for the race, as a valuable, planned experiment.

The results were better than had been expected. Not one of the thirty-three cars that started the race was forced out by an exhausted fuel allowance, and of the dozen cars that finished the grind, the one that burned the most had two gallons left in its tank. Cummings used twenty percent less fuel than did the winner of the 1924 race—and he traveled six and a half miles an hour faster in doing it. To encourage further development along this line, the conditions for this year's race set a fuel limit of forty-two and one half gallons.

Race drivers didn't give much thought to their fuel until 1923. They used ordinary gasoline and let it go at that. Then it was found that a certain well near Bakersfield, Calif., supplied a highly volatile gas that developed more (Continued on page 79)



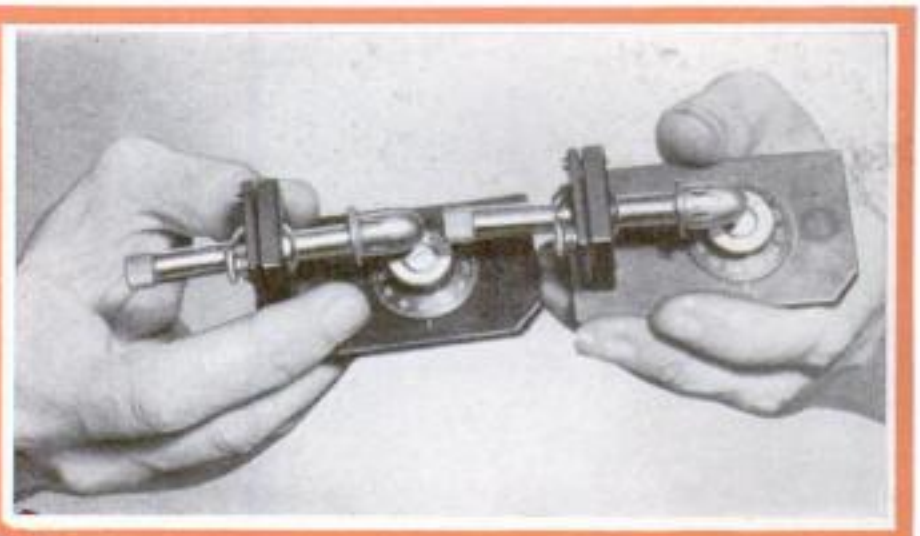
Above, racers in the last lap of the British Empire Trophy Race. At right, Fred Frame, the famous race driver, is testing his car in the autometer, a device that shows the car's performance at great speeds



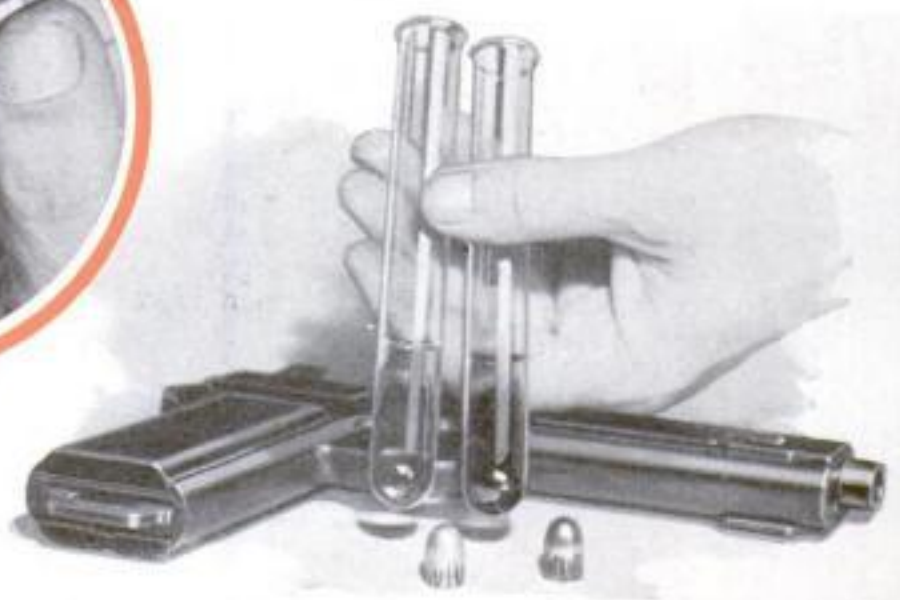
The ancestor of the streamlined passenger automobile. This bullet-shaped car was driven by Barney Oldfield in races at Sheepshead Bay, N. Y., many years ago, in a series of heats in which Ralph DePalma (in No. 4) defeated Oldfield and Chevrolet

Black-Chamber Sleuths Solve Baffling Crimes

Left, using the revolver of a suspect to fire a control bullet into a long box wadded with waste. This stops the flight of the bullet, which is retrieved and examined. Below, a high-speed drill is extracting metal from bullet for analysis and contrast



The control bullet and a hold-up slug mounted side by side in chucks for comparison of marks under microscope



COLOR TESTS OF BULLET CHIPS SHOW ALLOYS

Manufacturers use various alloys in bullets. Chemical tests identify these alloys. Arsenic turns solution in test tube canary yellow, antimony turns it reddish orange, and tin produces a lemon-yellow tinge

HIDDEN MESSAGE HOLDS CRIME CONFESSION

A detective reading a letter that contained two messages, one in ordinary ink, the second in invisible ink. Under the rays of the ultra-violet lamp, the second message was read; in it the writer admitted he had committed a robbery

By analyzing light rays, the remarkable machine shown at the right, a spectrometer, makes known the chemical composition of materials such as metal, blood or soil. It provides remarkable evidence

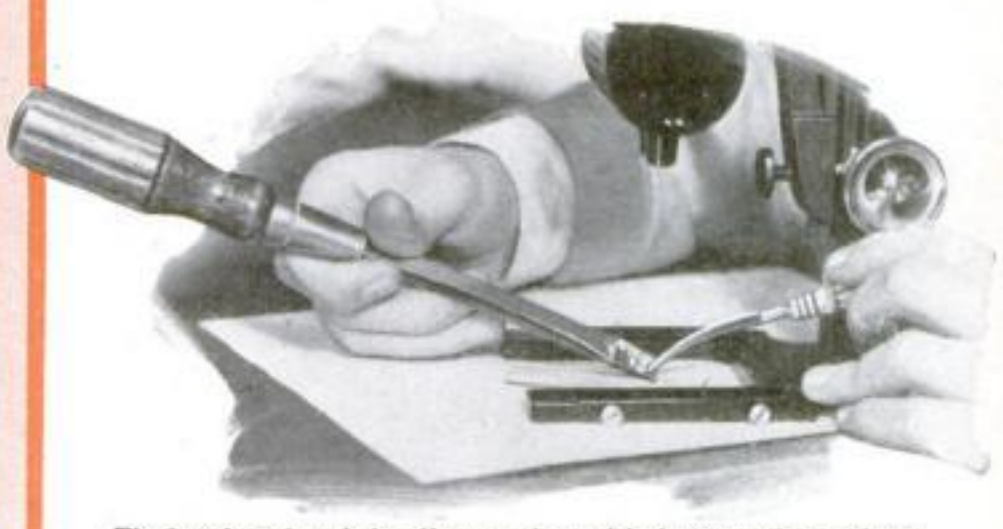
Below, searching the tiny holes on the surface of a sledge hammer, for particles of debris. This microscope itself casts a peculiar penetrating light

TRAIL OF GUNFIGHT DRIVER LEADS TO HIS BEDSIDE

A detective at the wheel of a crime car deduced from position of bullet holes and bloodstains that the driver had been wounded in the right arm. The driver was arrested in hospital. Below, with tweezers, a bit of fabric is being tested on a "spot plate" for presence of human blood

A SMEAR of green paint marked a screw driver found in the possession of the suspect, but he stoutly denied having been anywhere near the big green house where a burglar had jimmied the back door. In fact, he offered what appeared to be an attack-proof alibi. To the "black chamber" of the Los Angeles, Calif., police department, where three laboratory experts headed by Lieut H. C. Nutt specialize in unraveling faint clues, went the screw driver for examination. With the aid of a microscope and scalpel, one of the scientific sleuths gingerly peeled away the paint stain and discovered a striking fact. It was a three-layer "sandwich"—dark olive-green on the outside, then gray, and finally pastel green next to the metal. The expert hastened to the house where the burglary was committed, studied the layers of paint on the door with a magnifying lens. There were the same three colors, in reverse order! The burglar had made the mistake of choosing a house that had been repainted in different colors, and the evidence broke down his alibi and led to his conviction. Feats like this are crude in contrast with some of the delicate tests that these experts have successfully made to solve crimes ranging from robbery to murder. Photographs on these pages, made especially for POPULAR SCIENCE MONTHLY, show the part these dramatic tests have played in actual police cases.

Tracing angles and curves in handwriting, to prove that a defendant signed a receipt for a pistol, despite a strong denial



The burglar who tried to jimmy a door with the screw driver shown above made the mistake of picking a house that had been painted three times. Detectives peeled three layers of paint from the tool

Sculptors Restore Face of Early Man

The first step in reconstructing the likeness of a man who lived in ages past. To his skull are affixed little buttons indicating the probable depth of the skin and flesh. Next, the spaces between the buttons are filled with clay, and the contours smoothed

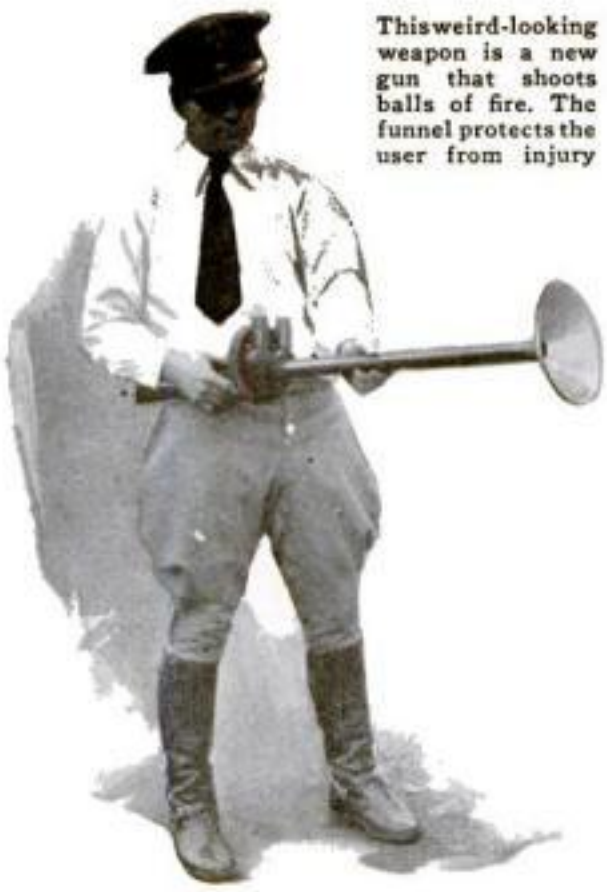
A face seen last long centuries ago is reappearing here. The sculptor still must work out the details of one side

From the reconstructed head of a Viking of the Tenth Century the white plaster portrait shown above was cast. An assistant is using calipers to compare measurements. Left, the realistic image of an Ice Age man and the skull from which it was made. Note peculiar facial expression

Like a modern prize fighter's is this venerable countenance. It belonged to the Old Man of Cro-Magnon, who lived in Austria 20,000 years ago. Below, an Asiatic of the Eighth Century. His skull was excavated in Hungary

ACCURATE likenesses of people who lived hundreds or thousands of years ago are being created in sculpture through an ingenious process developed at the Natural History Museum of Vienna, Austria. The resulting busts depict prehistoric men in so lifelike a way that they would instantly be recognized if met face to face; giving a far more vivid impression to laymen than an unadorned collection of skulls. According to Dr. Victor Lebzelter, museum anthropologist who devised the process, two features clearly define the physiognomy of every race—the bony skull itself, and the muscular and fleshy tissues that overlie it. Post-mortem head measurements, among modern races most nearly related, enable him to estimate the original thickness of flesh at various points on ancient human skulls in the museum's prized collection. Plastic buttons of corresponding thickness are fastened to reference points on the skull, and the contours filled in. The plaster cast from the resulting model is said to be an accurate representation. Only the eyelids, the lips and tip of the nose are left to the imagination.

By the new process was produced this singularly modern-looking profile. It was molded upon the facial bones of an aboriginal Canary Islander, a Cro-Magnon of remote past



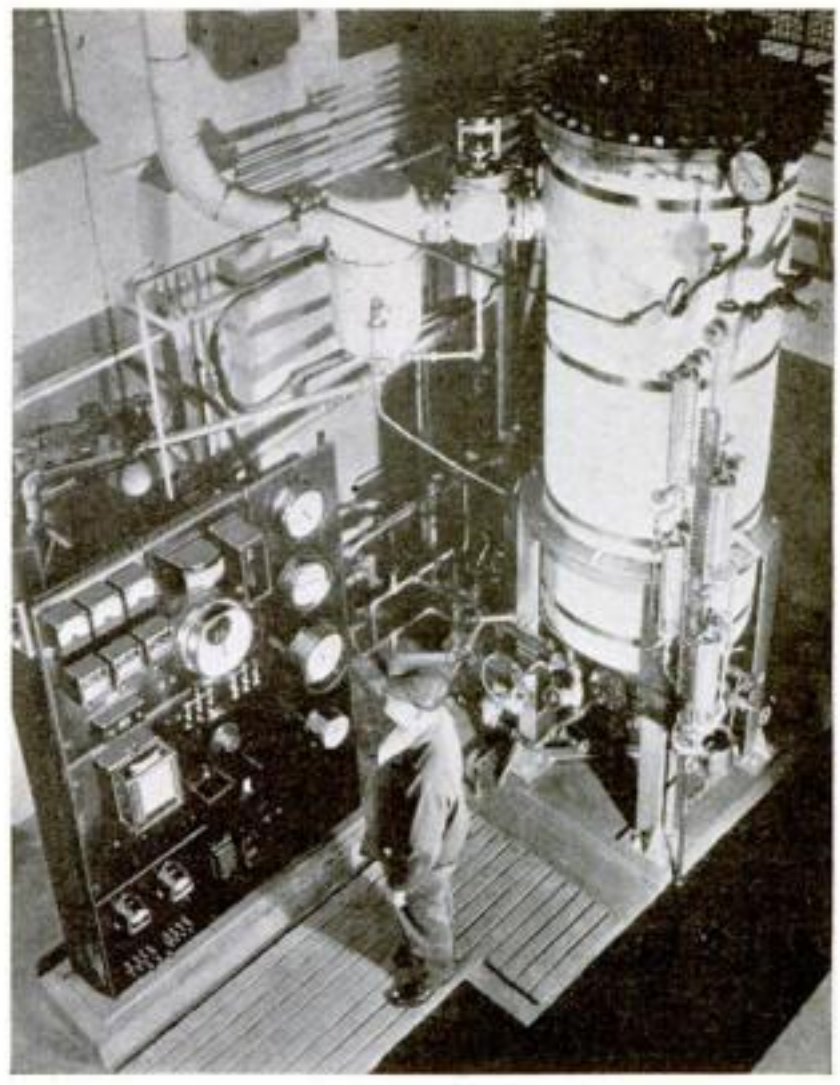
This weird-looking weapon is a new gun that shoots balls of fire. The funnel protects the user from injury

GUN SHOOTS FIREBALLS

A GUN that shoots balls of fire is a western inventor's contribution to warfare, representing an attempt to modernize the Greek fire of the ancients. The new gun would be used to project incendiary pellets of a powder composition at low-flying aircraft. The odd weapon has a capacity of eight shots before reloading.

BOILER MAKES STEAM BY ELECTRICITY

REVERSING the customary practice of using steam power to generate electricity, a Montreal, Canada, milk and ice cream plant uses electricity to make steam. Its four coal-fired boilers, of 150-horsepower capacity each, have just been replaced by a new electric boiler that operates without soot or smoke. Favorable electrical rates are reported to make electricity a cheaper "fuel" than coal. Water is heated by its own resistance to current flowing directly through it, between submerged cast-iron electrodes. Altering the water level in the boiler controls the rate of steam production, by varying the depth to which the electrodes are submerged and, hence, the amount of current flowing. An interesting supplementary method of control is by injecting small quantities of salt into the water to lower its electrical resistance. A central switchboard regulates the process.



Control board that operates an odd boiler for generating steam from water by its resistance to an electric current sent through it

SKIN SHEEP BY COMPRESSED AIR

Skinning sheep on a Wyoming ranch by means of compressed air

SKINNING a sheep with the aid of compressed air is an innovation that has been tried out successfully in Wyoming. The air, injected beneath the hoof of the animal under a pressure of from forty to fifty pounds per square inch, inflates the skin and separates it so effectively from the carcass that an expert skinner can remove it in forty to fifty seconds. Thus the hides are sped on the way to the factories where they are made into sheepskin coats and other articles of apparel. The photograph at the left shows the new process in actual use by skinners.

Demonstration model of new airplane controls that are said to make flying as easy as operating an automobile

OUTBOARD RACERS BORROW A SPEEDWAY TRICK

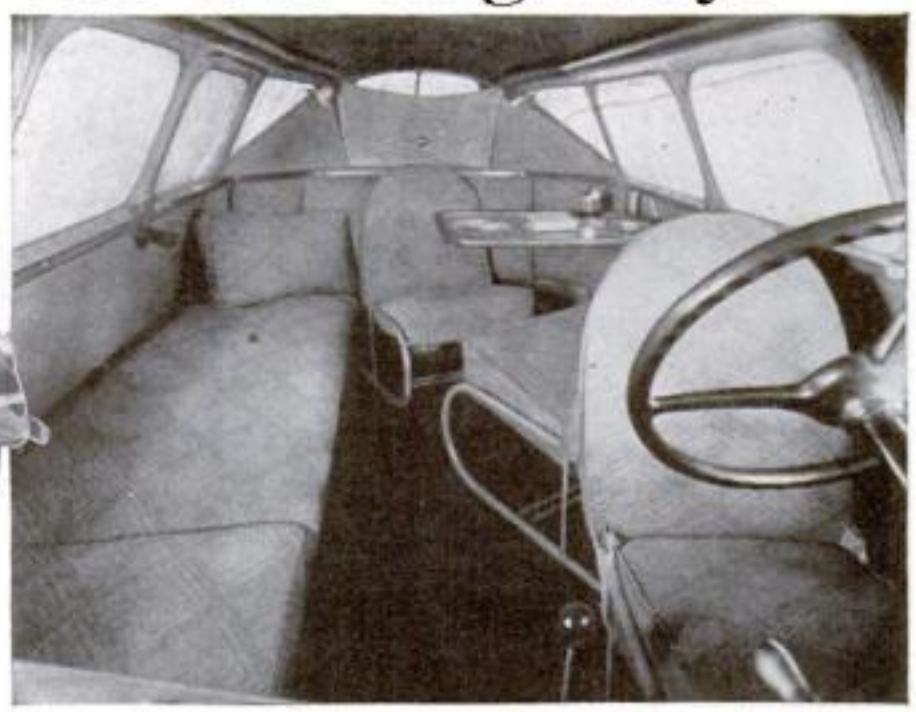
WITH the increasing popularity of long distance races for outboard speedboats, drivers are utilizing an old trick of the automobile racing game in getting from their "pit" workers such information as the number of laps they have made, their average speed, how much of a lead they have over their competitors and other useful data to the driver and his mechanic. A large piece of plywood is used by one of the shore men to flash data to the boat as it speeds past the "pit" where the mechanics stay.

NEW CONTROLS DRIVE PLANE LIKE AUTOMOBILE

AIRPLANE controls of a new type, invented by a former Army pilot, are designed to make flying a plane as easy as driving a car. The conventional control stick, and rudder bar or stirrups, are eliminated. The ship is nosed up or down by depressing the toe or heel, respectively, of a foot pedal. To make a turn, the pilot simply spins a combination steering wheel in the desired direction. The wheel is composed of two split sections mounted one below the other. One operates the rudder, for directional control; the other, the ailerons governing lateral inclination or "banking."

Auto Provides Club Car For Highways

Below, exterior of the new beetle-shaped automobile, as seen from the rear quarter. Photo at right shows the unusual interior arrangement which affords its passengers all the comforts of a cozy drawing-room



"FORWARD" and "aft" are terms used by the maker in describing cruiserlike accommodations of a beetle-shaped automobile just introduced to American motorists. Easy chairs within the roomy body may be arranged about a folding table, while a wide rear seat, equally movable, may be swung around lengthwise of the car to serve as a lounge. An extremely low center of gravity insures freedom from swaying. According to William B. Stout, noted airplane builder and designer of the new car, the unconventional machine is shaped with the primary purpose of making steering easier.

BUILDS WORLD'S BIGGEST FIDDLE

Fourteen-foot bass viol being played by its builder with the aid of a platform

ALONG with several other original and curious musical instruments, an elderly violin maker of Ironia, N. J., has built what he believes to be the largest bass viol in the world. It is fourteen feet tall and the sound box alone measures seven feet in height. The bridge is so far above the ground that the giant fiddle can be played only with the aid of a platform. The neck, bridge, and tailpiece are detachable to make it more easily portable. Of the several instruments invented by the builder of the huge bass viol, the strangest is a "horn of plenty" harp, with forty-three strings and a sound box like the horn of a public address system. A hybrid harp and 'cello, known as a lute-harp, a dwarf 'cello, a smaller lute-harp, and a queer violin-like instrument with three necks and harp strings, complete his collection. A landscape gardener by profession, he makes violins in his spare time.

The inventor displays a model of a boat to be driven by the power of waves. In tests, the model made a speed of five miles an hour

WAVE POWER RUNS MODEL BOAT

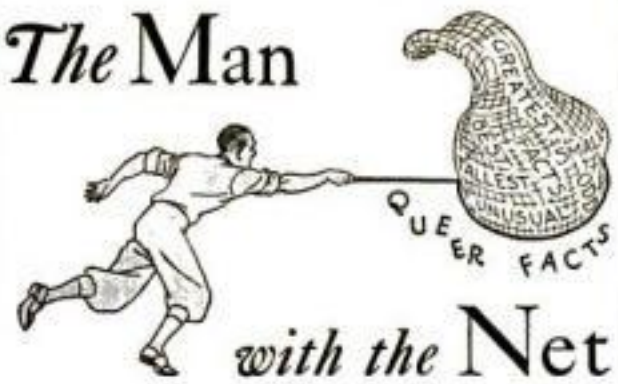
USING the power of the waves to drive a stationary power plant has been proposed before, but it remained for a Long Beach, Calif., inventor to design a wave-operated mechanism to propel a boat. Models used to try out the odd principle are reported to have shown surprising speed in tests, one miniature eighteen-inch craft attaining a pace of five miles an hour. Similar gear, the inventor suggests, could be applied to any full-sized craft, and could be attached or removed at will. The equipment comprises three fins attached to flexible joints, which are set vibrating by the slightest motion of the water, and are interconnected in such a way that they transform the vertical movement of the waves into impulses that drive the boat forward.

MAGNIFIER HAS BUILT-IN LIGHT

A HANDY magnifier with a built-in electric lamp has just been placed on the market by a Texas manufacturer. It is designed especially for the use of stamp and coin collectors, natural history students, and others who habitually examine small specimens. The lens is pre-set at the proper focus and is enclosed in an aluminum housing three inches high. All that is necessary is to connect the device to the nearest electric outlet and place the specimen beneath it. The interior of the reflector is finished with a dead mat surface to provide diffused illumination throughout the field of vision.

Close-up of model, showing fins that gather energy from waves

The Man with the Net



PARADOXICAL FROGS *of South America are bigger when they are young than when they are full-grown.*

FIFTY YEARS AGO, *only ten electrical companies existed in the whole world.*

THREE-DIMENSIONAL ILLUSTRATIONS *form a feature of a new textbook on physics. The pictures, in pairs, are viewed through a stereoscope which accompanies the volume.*

STARFISH MUSCLES *can exert a steady pull for forty-eight hours.*

TWO LETTERS, *posted in New York at the close of a business day, will both arrive at their destinations at the same time if one goes by air mail to Omaha, Neb.; the other by ordinary delivery across the street.*

ONLY MEN *of fifty-five or older can work in one department of a Detroit automobile factory. Their jobs require patience and experience.*

THE NAME *of Stradivarius has been forged more than any other in history. For more than two centuries, imitations of his famous violins have appeared in all parts of the world.*

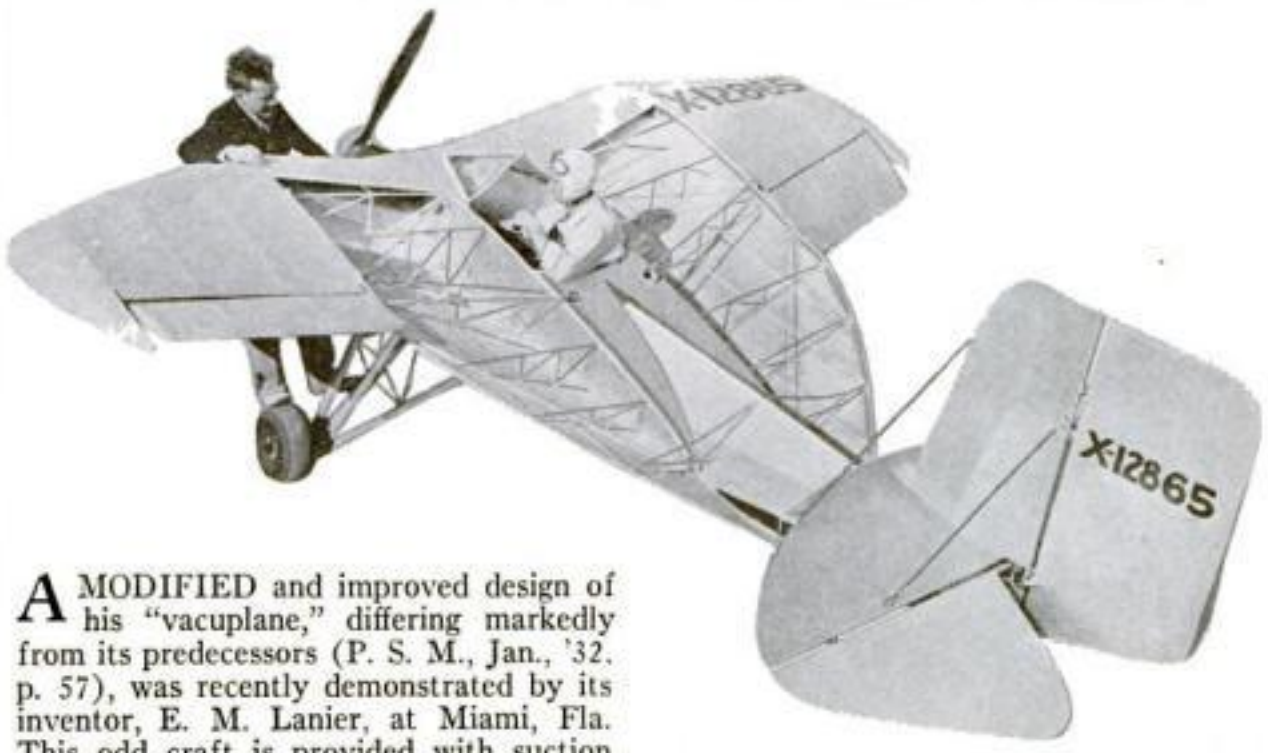
SEA WORMS *have 20,000 barbed bristles which they shoot like arrows at their enemies.*

WHEN *tea was sweetened with molasses, it sometimes turned to ink. The iron which entered the syrup from kettles in which it was boiled combined with tannin in the tea and produced black iron tannate, now employed as an iron ink.*

GIRAFFES *were nearly wiped out by World War bullets. Their long necks broke telegraph wires strung on poles by colonial troops in Africa and orders to shoot the animals on sight resulted in the destruction of large numbers. Since the war, special regulations have protected them and they are rapidly multiplying again.*

RED AUTOMOBILES *are prohibited by law in Minneapolis, Minn.*

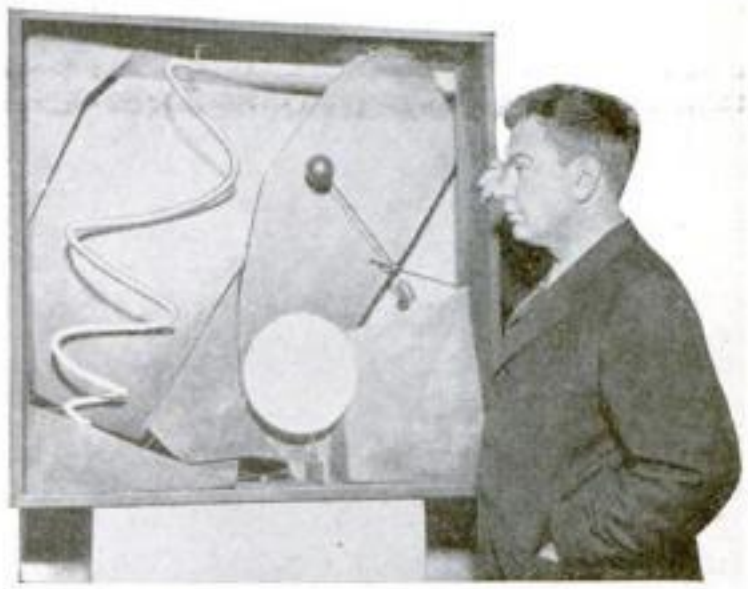
INVENTOR TESTS NEW SUCTION PLANE



A MODIFIED and improved design of his "vacuplane," differing markedly from its predecessors (P. S. M., Jan., '32, p. 57), was recently demonstrated by its inventor, E. M. Lanier, at Miami, Fla. This odd craft is provided with suction cells on its upper surface, which are said to increase the lift and reduce the required wing area. The new model weighs 360 pounds, is only sixteen feet long, and is reported to have a speed of ninety-six miles an hour. The plane is shown above with its inventor, at left, comparing notes with his pilot on the machine's performance.

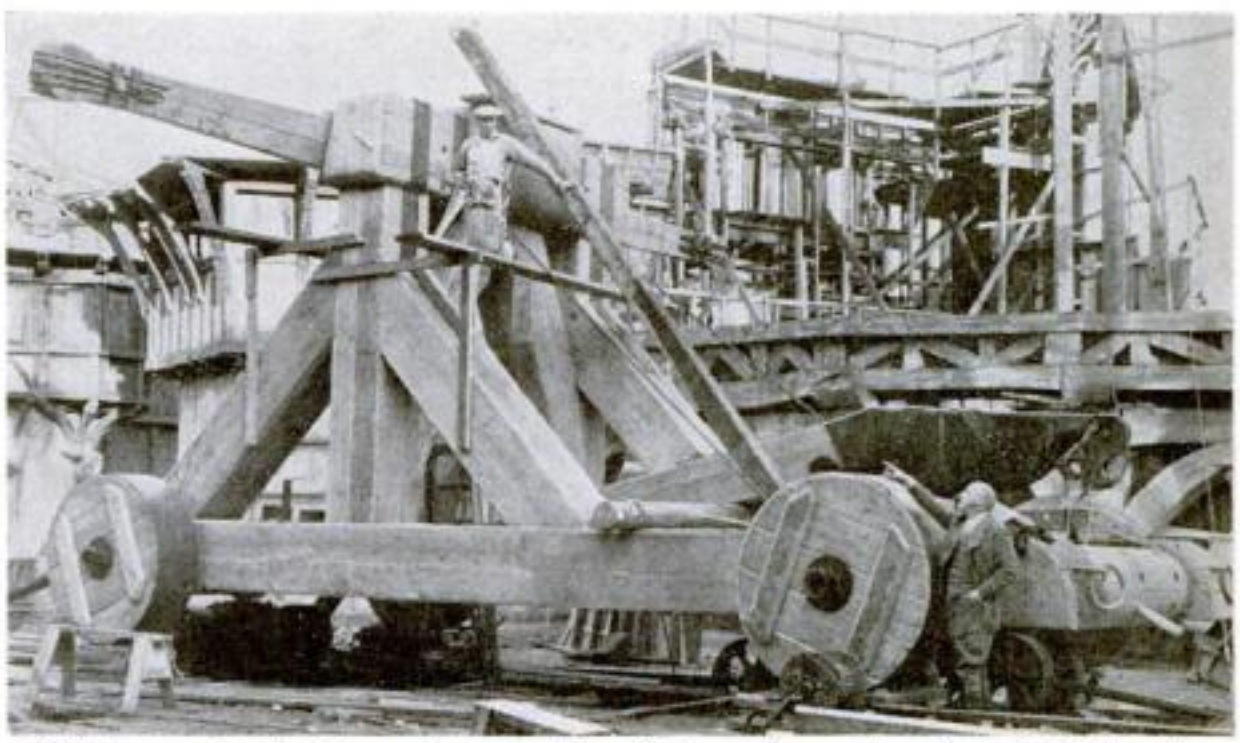
MOVING GADGETS MAKE NEW "ART"

MOTOR-DRIVEN art is the creation of Alexander Calder, sculptor, who recently exhibited some of his remarkable designs at the University of Chicago. His "pictures" consist of abstract designs of disks, balls, rods, and wires that are simultaneously set in motion by pulleys and springs, of which an example that he calls "Black Frame" is illustrated at right. According to Calder, the rocking and bouncing objects present a new medium of artistic expression.



REPRODUCE ANCIENT SIEGE ENGINE

WEIGHING eleven tons, a giant catapult built in Hollywood for use in a motion picture depicting the Crusades is claimed to be the largest single movie "prop" in the world. Its size may be appreciated by comparison with the men standing beside it in the picture below. The sham war engine closely resembles those actually used in ancient sieges, to hurl rocks weighing up to 1,800 pounds. The crude projectiles were not directed against the defenders, but at their fortifications.



Full-size reproduction of an ancient catapult made for use in a motion picture of the Crusades

SHUTTERS SHIELD PLANE ENGINE FROM COLD AIR

To SHIELD its engine from frigid winds, an airplane destined to ply the world's most northerly air route has been equipped with a new kind of air shutter. Controllable from the cockpit, the device cuts off air both from the cylinders and the crankcase of the engine. Previous types of shutters have protected the crankcase alone. With the shutters closed, the plane is said to gain five miles an hour in speed. The plane is also provided with rubber mats on the sides of the fuselage to protect it from ice thrown by the propellers. It has just been delivered for use in Alaska.

CARVES STATUES OF ICE

WITH his studio kept at a temperature of eighteen degree F., a Memphis, Tenn., sculptor carves 400-pound cakes of ice into statues for advertising purposes.

SYNTHETIC ECHOES MADE FOR TALKIES

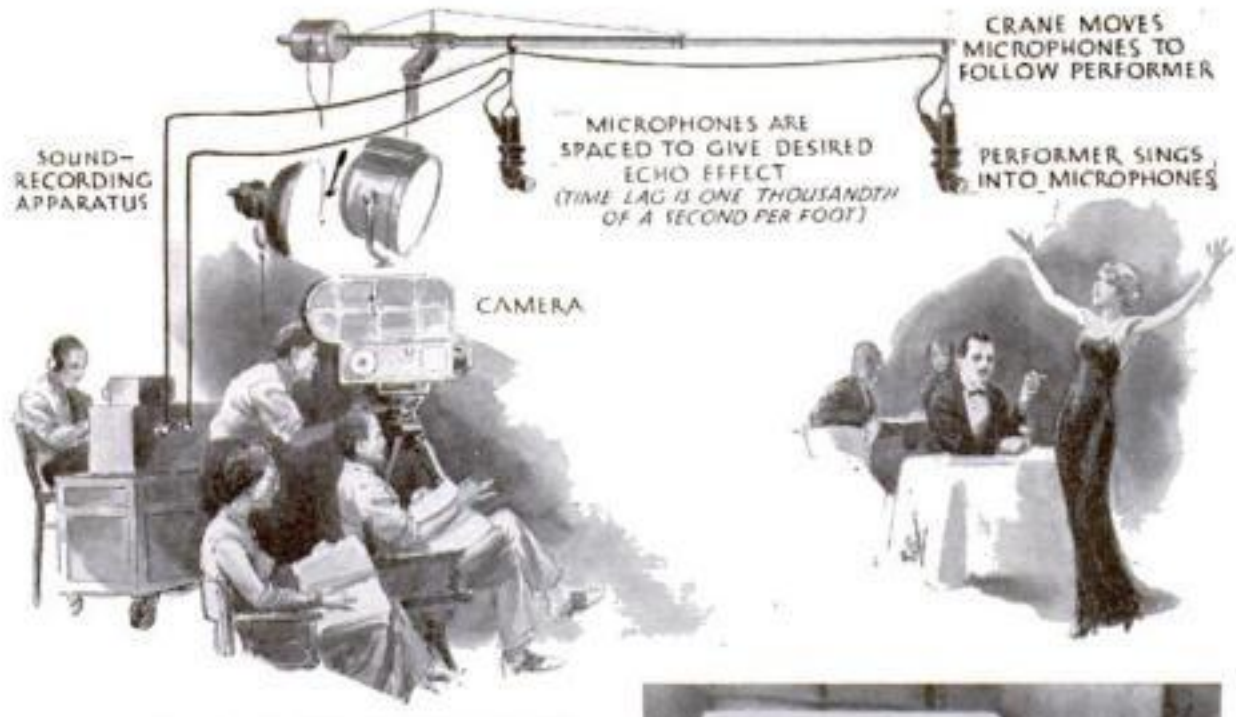
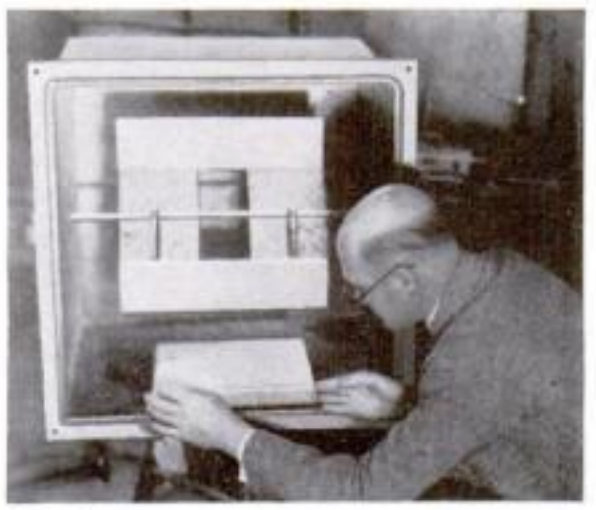


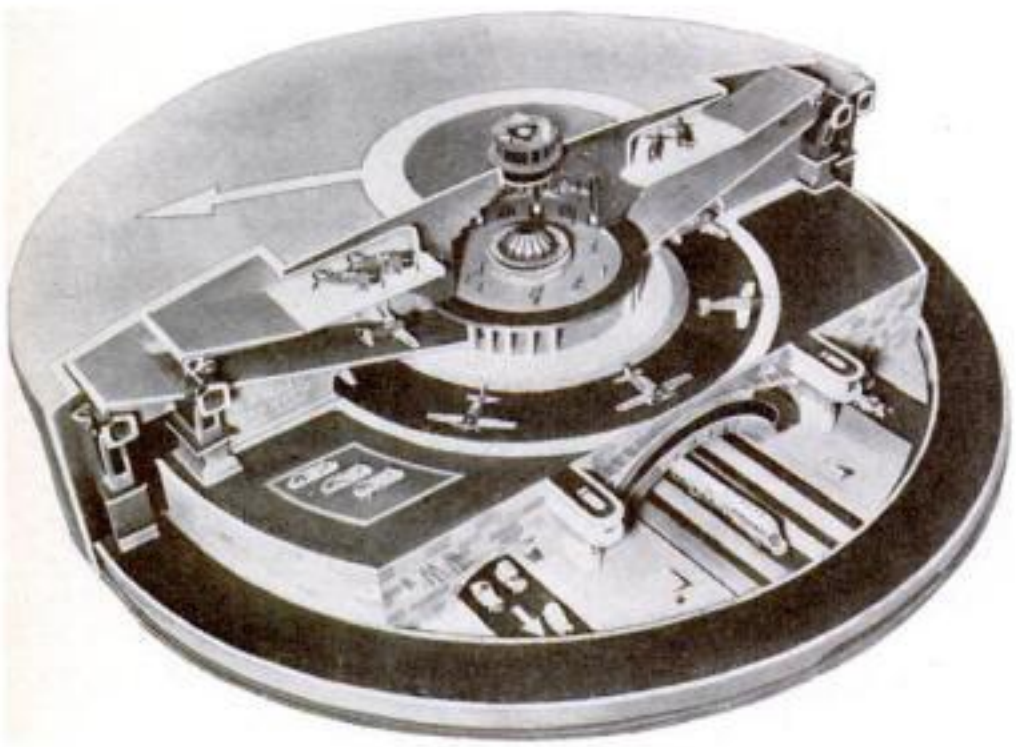
Diagram shows how twin microphones get an artificial echo for realism in talkies

BY HARNESSING echoes, sound men are adding new realism to the talkies. Recent scientific discoveries have shown them how to deaden unwanted reverberations or create artificial ones at will. A pioneer in this field, Prof. Vern O. Knudsen of the University of California, built a test chamber in which a louspeaker produced an artificial shriek, and a spinning paddle kept the air stirred while the echoes died down. By measuring the time this took, he compared the sound-absorbing qualities of materials ranging from burlap-covered board to a strange mineral substance that absorbs sound like a sponge.

Another problem long baffled sound men. When an actor walked away from the camera, his voice continued to sound near. The fact is that we judge the distance of a sound we hear not only by its loudness, but also by echoes that bounce back from walls and furniture in a small or large room. To supply realistic, controllable echoes, movie technicians arranged twin microphones as shown in the diagram. The nearest one picks up the voice first, and the other obtains an apparent "echo," the spacing being chosen to produce any desired time lag.



Testing a sample of building material for sound absorption in a special test chamber



MODEL SHOWS SUBTERRANEAN AIRPORT

SUBTERRANEAN airports are foreseen for use in peace and war by Dr. William W. Christmas, pioneer aircraft designer, who recently exhibited a model of such an air terminal. In his plan, incoming planes land upon the bowed roof of the airport, and travel down ramps to lower levels to discharge passengers and cargo. The structure also serves as a terminal for pneumatic mail tubes.

TUBES REPLACE STRINGS IN PIANO

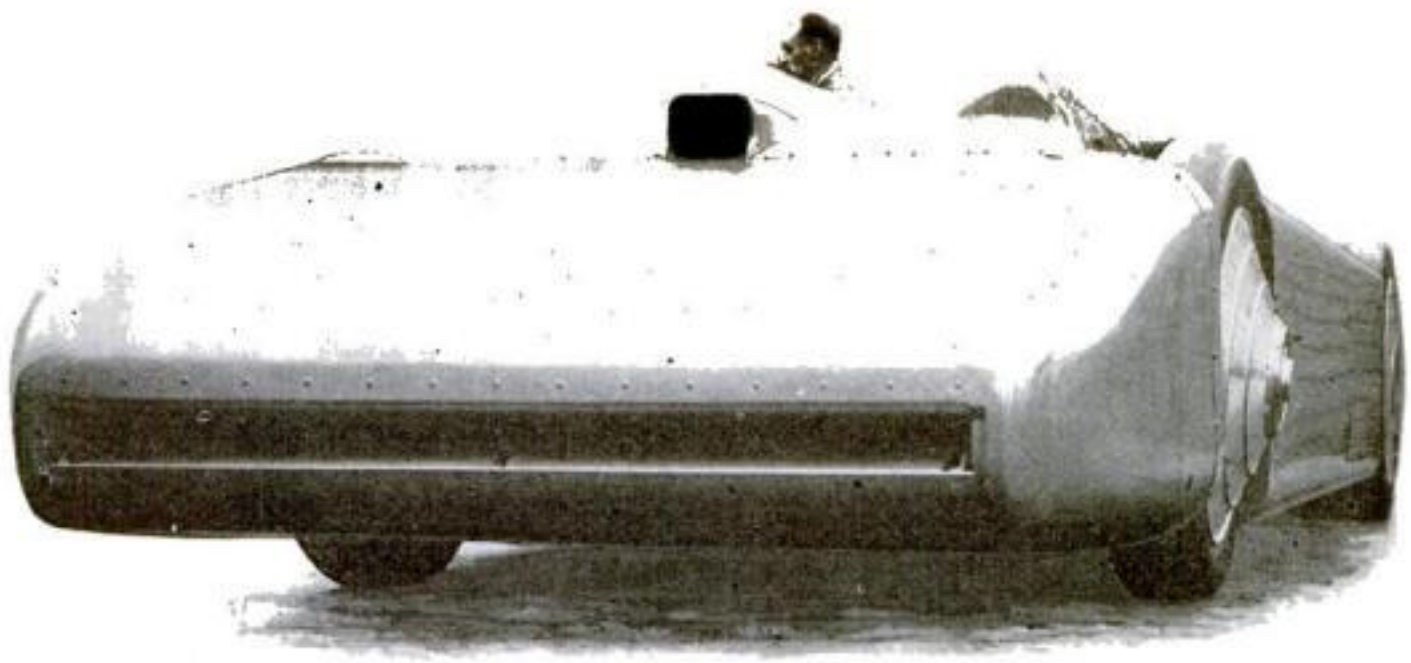
A PIANO that never needs tuning has been constructed by a Los Angeles, Calif., inventor. Its chimelike notes are sounded upon forty-nine tubes of metal alloy, which replace the usual steel strings. A standard keyboard is used to play the odd instrument, which has a compass of four octaves. The inventor has made instruments fifty years.

Novel piano in which tubes of metal alloy replace usual strings

ADJUSTABLE HOOK HOLDS DOOR SHUT

AN ADJUSTABLE hook that may be lengthened or shortened as desired is a newly invented household convenience. The adjustment, made by turning a milled collar, aids in fastening a warped door or screen. It also provides a means of tightening the hook to serve as a lock, closing the door so tightly as to prevent a would-be intruder from prying the crack of the door open in an attempt to gain entrance.

Arrow points out milled collar that regulates length of hook



NEW RACING CAR RESEMBLES WHALE

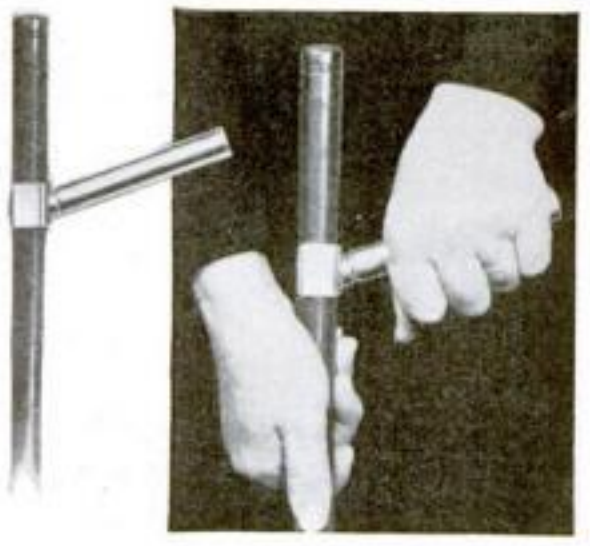
FOR Sir Malcolm Campbell's latest assault upon the world's automobile speed record, British engineers turned out a car that has no counterpart. A long slot at the whalelike snout of the monster admits air to cool the huge engines. Guiding the Juggernaut from a sunken cockpit, the driver is shielded from the terrific air blast that occurs at speeds of more than four miles a minute. The great bulk of the car is occupied by its powerful engines.

BURSTING BOMBS SMOTHER FIRE

BOMBING a fire to put it out is an innovation foreshadowed by recent successful experiments at Rome, Italy. The anti-fire bombs tried out for the first time in these tests go into action at the ends of long poles. Exploding, they scatter a smothering blanket of chemicals on the flames, as shown in the picture above, which was made as the bombs were being demonstrated in use against an artificial blaze. The picture at upper right gives a close-up view of one of the bombs held on a fireman's pole. It suggests an oversize rifle grenade.

PRACTICE GRIP FOR GOLF CLUB IMPROVES PUTTING

LEARNING the correct golf stroke in putting is said to be made easy by practice with a diminutive attachment for the club, comprising a revolving grip and a clamp for attachment. When the grip is held against the leg as shown below, and the other hand is used to swing the club, it naturally follows the motion of the "pendulum stroke" that skillful golfers use, and increases accuracy of shots.

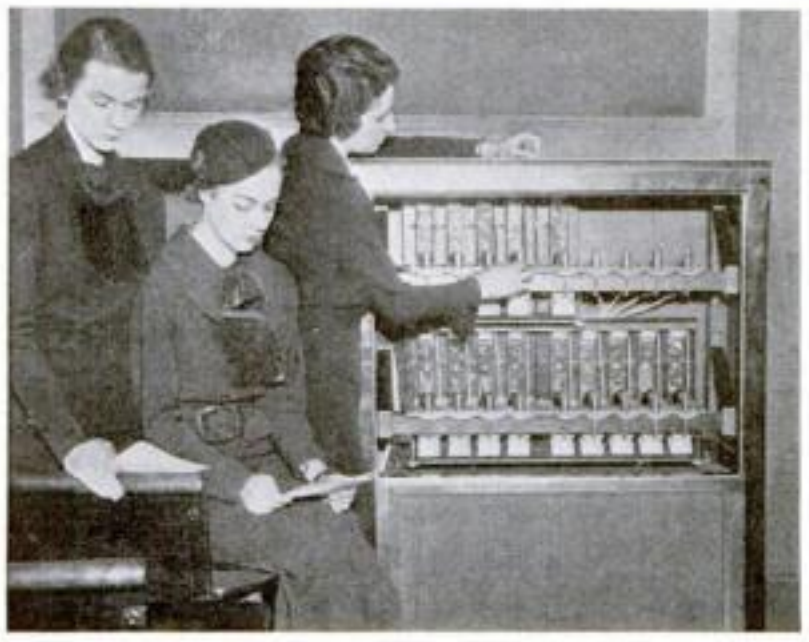


MAGNET IS USED LIKE A BROOM

A "MAGIC MOP" is the answer of General Electric engineers to the problem of getting rid of ball bearings spilled on their factory floor. The magic is provided by a sliding electromagnet on the handle. Pushing the magnet down automatically energizes it for picking up the bearings. When the magnet is raised the power is cut off, and the metal balls drop into a receptacle for disposal.

Picture shows ball bearings clinging to electromagnetic "mop"

DEVICE TESTS EAR FOR MUSIC



WHETHER prospective music students have sufficient inborn talent to justify their studies is revealed by a novel testing device developed at Northwestern University. It consists of fourteen steel tuning bars, each differing in pitch from the next by only a quarter of a tone. If a subject can distinguish one from the next when they are struck, he is qualified to play a stringed instrument demanding a sense of pitch. If not he must stick to piano.

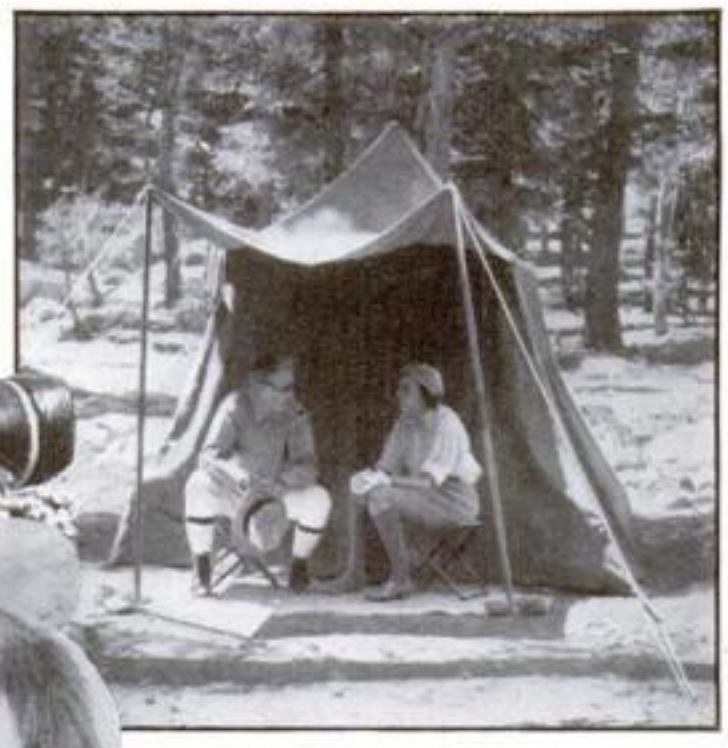
LET ME HELP YOU PLAN

Your Camping Trip

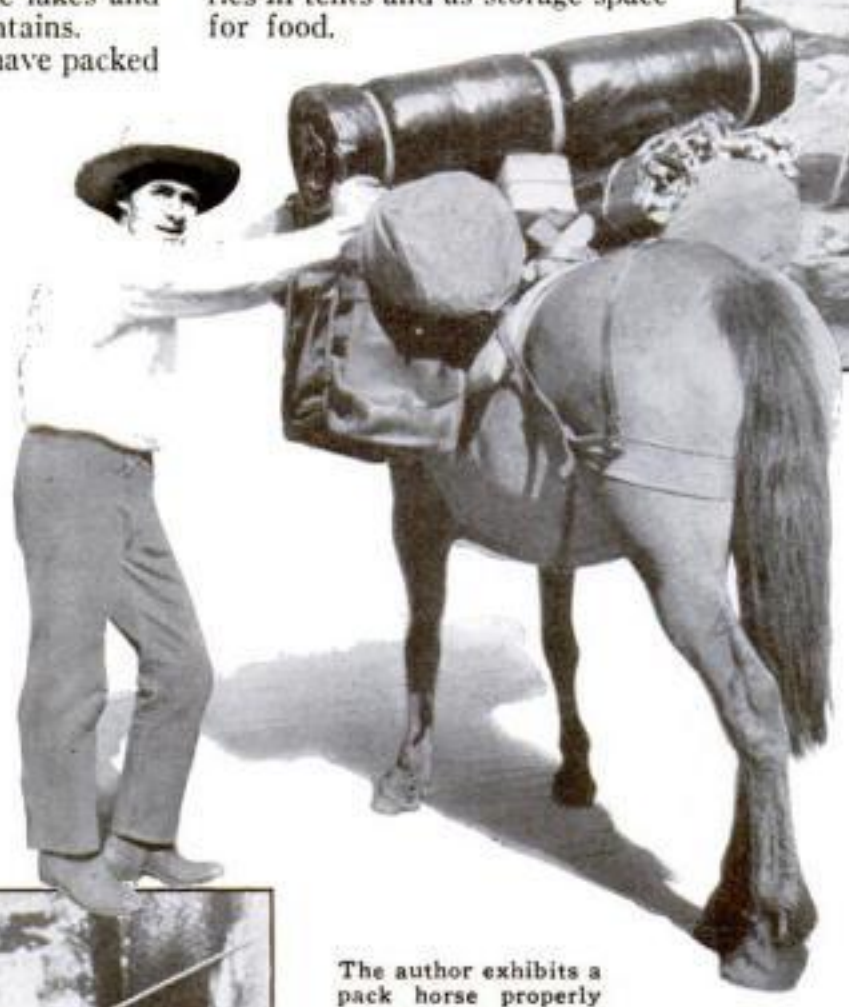
TAKE enough bedding for comfort, an insect-proof tent, only enough food to last. Add fishing tackle, matches in a waterproof box, a compass, a little concentrated food for emergencies, a strong knife, and a gun. Mix it with nature for two weeks. There you have the formula for a successful and comfortable camping trip, no matter whether in the woods of Maine, the Ozarks of Missouri, or among the lakes and streams of the California mountains.

During the last ten years, I have packed many parties into the high Sierras of California. Without exception, those who had the best time were those who had the foresight to carry enough conveniences to shorten the daily camp routine and give them maximum hours on trails and lakes. There's no need for those accustomed to easy living to punish themselves by a too rigorous routine in the open.

If you plan to pack in to some spot inaccessible by automobile, put up all your groceries in small boxes, such as canned-milk cartons. Try to have all of about equal weight. Each pack animal will carry from 150 to 200 pounds, depending upon altitude and the distance to be packed; and the load must balance. Also, equalized loads in small packages make it possible for a horse to carry forty to fifty pounds more, thus saving time and expense. Later, the boxes will prove useful as shelves for toilet accessories in tents and as storage space for food.



A single-pole tent like this will accommodate three people. Mosquito netting keeps insects out. The flap can be left up or down



The author exhibits a pack horse properly loaded with tents, bedding, and groceries

HANGING CUPBOARD FOR OPEN FOOD

Open food should be kept in a box suspended from a rope. A rubber poncho makes it weatherproof and can be used as a cape, as seen at the right

Since there are limits to the load you can carry conveniently—and this is true whether you use pack horses or your car—take no more than is necessary. Foodstuffs are particularly heavy. Sit down with pad and pencil and plan each meal before you start on your trip. You will find you require less than you would buy if you guessed at the amounts.

Unless you take along a trailer, suit cases have no place in camping trips. It is better to pack all small objects, including blankets, pillows and boots, in duffel bags, fourteen inches in diameter and thirty-six inches deep, for convenience.

Soft objects, such as bedding, may go in one, while bottles, pans, and the hard items go in the other. Separate metal and glass objects by layers of cloth or a pair of socks, not only to distribute the weight but also to prevent rattling. More than one pack horse has become frightened and bolted down a mountain trail because he heard a wash basin rattling against a flash light. Place clothing and accessories needed first at the top, particularly if you plan to stop on the way to your camp spot.

Do not pack in more than ten miles unless you are accustomed to riding, and plan to reach your camping spot by noon. This gives you time to pitch your tent, make cooking arrangements, lay out a cupboard, and be ready for hiking, hunting, or fishing when the sun breaks through the trees early next morning. If possible, select a spot which is shady during the day but receives the morning sun.

By giving your attention to a few details during your first day in camp, you will minimize your labors for the remaining weeks. Tents, stoves, and food should be placed in protected areas and fastened firmly to the earth or trees as protection against wind, rain, and insects.

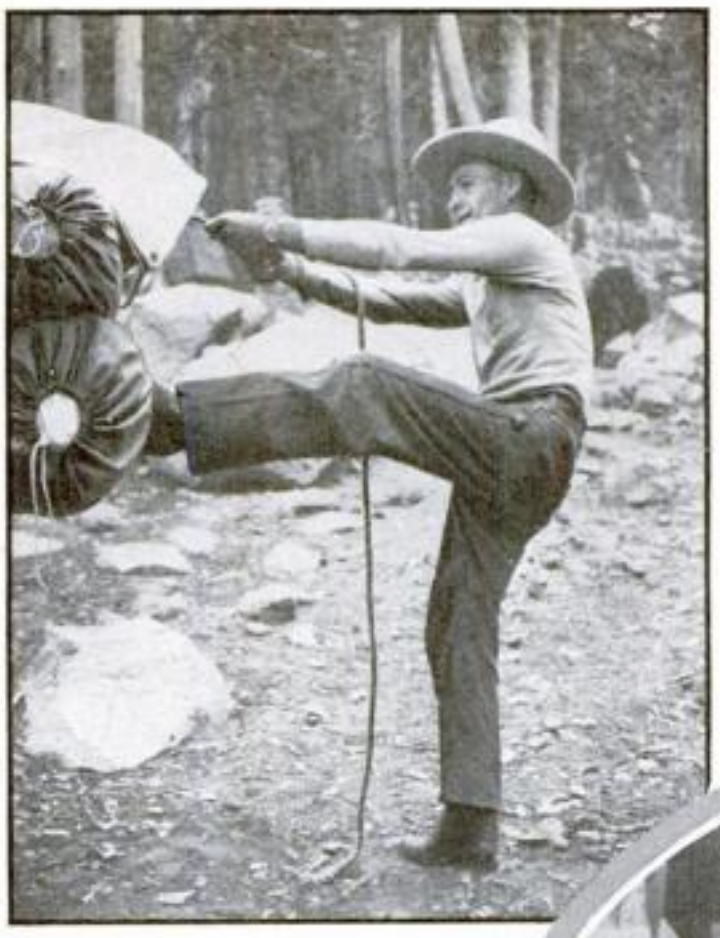
Be sure to have plenty of ventilation in your tent. As a safeguard against colds, it is better to have a floor. Most modern tents come with a canvas flooring of the same color and material as the roof. A mosquito-netting flap and a window of the same material will permit you to sleep in the open air and yet protect you from the annoyance of insects. In cold or wind, close the flap but leave the window slightly open. A raised section of canvas at the base of the entrance not only helps keep the floor dry, but also prevents the en-

April '35

A veteran packer of the Sierras tells you how to make your vacation in the outdoors more comfortable and pleasant

By

Billy Mowlds



How a real packer cinches up a load. Right, a windbreak between two trees shelters the camp larder from the weather

trance of snakes effectively.

If heavy rains are likely, dig trenches and throw up embankments on the high sides. These will turn any water that may threaten to wash over your site.

If you insist on cooking over an open fire, you will enjoy your food, but not its preparation. An outdoor stove may be easily built up of rock and a single sheet of heavy metal for the top. Be sure to face any open stove toward the prevailing wind in order to take advantage of natural draft conditions. It is essential to carry along a single length of stove pipe to stimulate the draft and carry smoke away from the cook.

I prefer a small gasoline stove. You can transport this type easily as a small package, about four inches thick and eighteen inches square. It is supported by legs which fold into a very small cardboard box. Fuel is no problem, since one gallon of gasoline will cook meals for a week. A portable oven, which folds into a package scarcely more than an inch thick, fits the top of this stove, making the baking of biscuit and cakes an easy matter.

Both the broiling and baking features may be combined in a single sheet-iron stove, fed with twigs and chips. This stove may be set up quickly by attaching the legs and fitting two lengths of stove pipe to the collar on top. It heats quickly. The advantage of this stove lies in the fact that it is light and may itself be packed with light utensils. Draft may be controlled by a damper which regulates heat in the oven. Cost is so small that the stove may be discarded at the end of the season.

Here are two methods I have found useful on the trail when traveling light. For frying a pan of fish and boiling coffee, I unfold the sheet-iron stove, cram a single newspaper page within it, poke in a few chips, and have a roaring fire in a minute. This little stove folds into a flat package, may be carried in the saddlebags, and provides a fire as hot as any range. It can be folded in a few seconds and made ready for another journey.

The second method consists in converting a two-pound coffee can into a stove which provides a fire hot enough to boil coffee and heat beans. Punch a few holes near the bottom, fill it half full of sand or loose dirt, place it on three or four rocks, and cover with any available open metal, such as screen or two or three metal rods. Then pour a cupful of gasoline over the dirt, and touch a match to it. If stirred occasionally, the gasoline will continue to flame until its purpose has been served.

In arranging your larder, remember that insects prefer sweets; chipmunks and squirrels attack anything they can reach; bears have a yen for sweets and meats and, in some climates, wet foods left open will spoil in a few days. Canned goods, foods in jars having tops, and sundries, may be left in the open. I have found it a good practice to build two shelves between adjacent trees, tying a piece of canvas at the back to serve as a wind break. This provides room for three tiers of supplies. Flour, corn meal, bacon, eggs, and opened packages should be swung in a box from a rope and covered by a tarpaulin or rubberized cloth. Wire the lower end to a tent peg driven into the earth immediately below. This arrangement is proof against both storms and small animals.

Even if you pack into the woods or mountains away from the stores, you may enjoy fresh eggs and butter no matter how long you remain in camp. Keep eggs in their cartons on the shelf. Place the butter in a pail and set it in the shallow water of a lake or stream, anchored or tied to a log for safety. The water should almost, but not quite, cover the pail. In this way, you can keep the butter cool and solid.

A HANDY CAMP STOVE

A collapsible sheet-iron stove in use for frying fish. It can be folded into a package an inch thick and about eight inches square

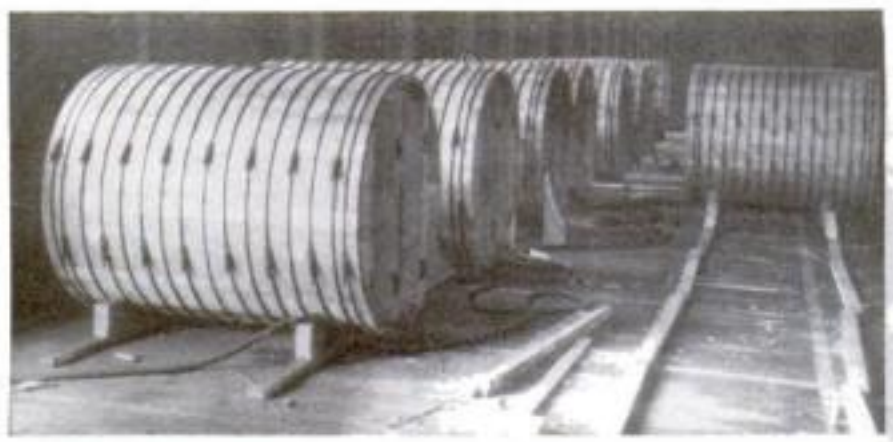
A permanent camp stove built up with stones and steel. It faces into the wind for draft, and has a pipe

Fruit should be eaten at every meal and one large can of vegetables or fruit serves four people. Breakfast of buckwheat cakes, pears, and coffee may be prepared in short order. For dinner, fish, lima beans, biscuit, young berries, and tea or coffee, may be cooked *(Continued on page 107)*

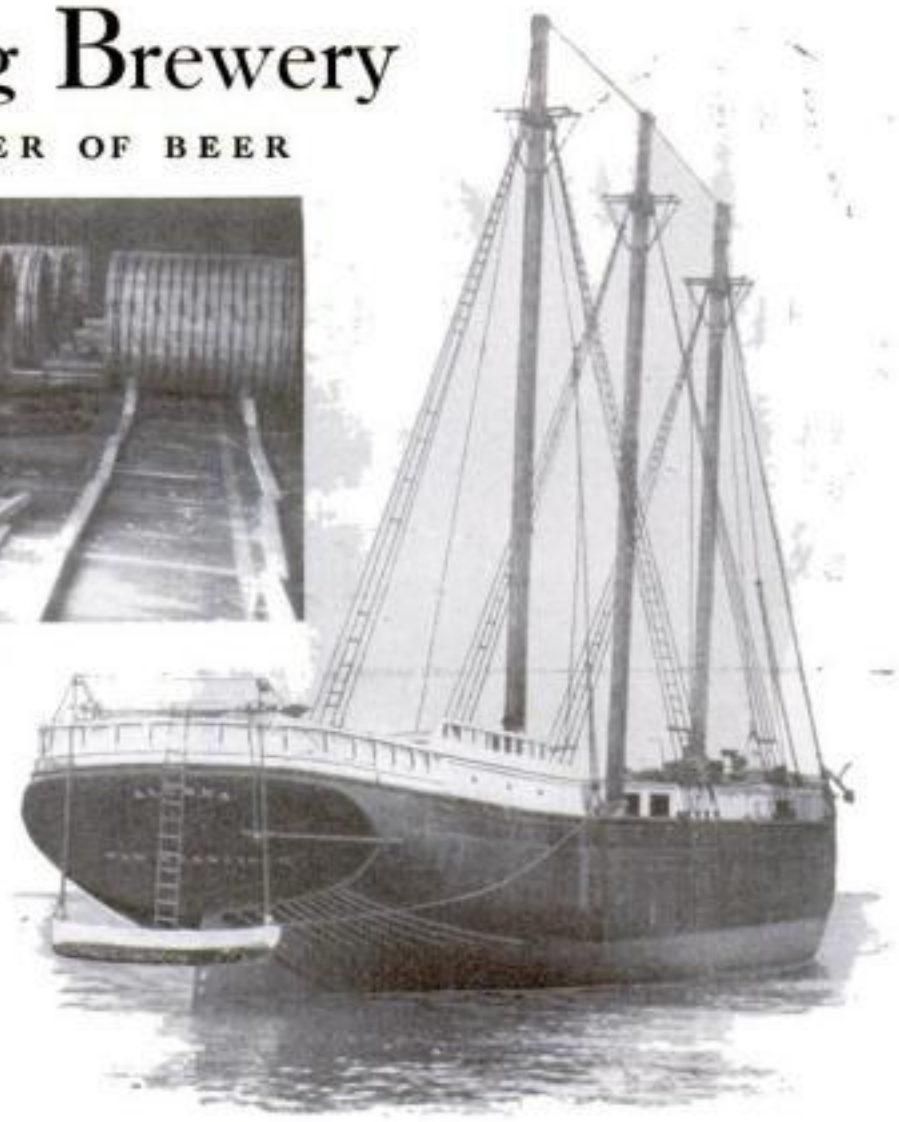
Ship Becomes Floating Brewery

ALASKA WILL GET A REAL SCHOONER OF BEER

CALLED the world's first floating brewery, the remodeled sailing vessel *Alumna* may set a new style in beer-making methods. Originally a Pacific lumber carrier, but forced off the sea by the competition of tramp steamers, the old craft has just been returned to service—this time as a complete manufacturing plant for beer, with a capacity of 250 half-barrels daily. A deck house was built forward to provide storage space for the raw materials and for the finished product, while fourteen fermenting vats of 100-barrel capacity each were installed in the hold. Present plans call for the beer ship to be towed along the Alaskan coast, making beer as it goes and selling it at every port. Smaller boats will also distribute the product to fishing fleets and isolated settlements. Since freight charges account for a large part of the cost of supplies purchased in Alaska, the innovation in beer making is expected to lower the price of the beverage materially and to make the enterprise profitable. If so, the owners foresee a new use for hundreds of old ships and barges now idle in American ports, which could be bought and transformed into floating breweries at a fraction of the cost of erecting plants ashore. This saving would be in addition to the economies effected in delivering the product to distributors and consumers.



A view aboard the seagoing brewery, showing a few of the drums in which beer is stored



The old sailing vessel *Alumna*, formerly a lumber carrier, which will make beer and deliver it directly to its market

Left, workmen printing photographic decorations on clay and dusting the sticky image with pigment for firing. Below, one of a pair of color plates, and the finished tile printed from it

PHOTOGRAPHS REPRODUCED ON TILE

TRANSFERRING photographic decorations to clay tile is said to be made commercially practical through a method recently developed. In the new process, the photograph is reproduced in large and small dots on a plate resembling a half-tone engraving, except that it is etched more deeply. The image is then transferred to a flat tile with the aid of an offset flexible roller, in a tacky, combustible material that serves as an adhesive for pigment dusted upon it with a powder puff. When the tile is placed in the furnace for firing, the color is burned into the clay.

MIRROR ON TRAP MAKES MICE RACE FOR BAIT

TO LURE mice to their destruction, an Illinois inventor is introducing a small convex mirror to be attached to a trap, or set near-by. A mouse that sees its reflection in the wide-angle mirror, the inventor maintains, will imagine it has competition and will rush for the bait. Whether or not this is sound mouse psychology, traps equipped with the mirrors are said to have proved effective in disposing of rodents where they have been put into use over considerable periods of time.

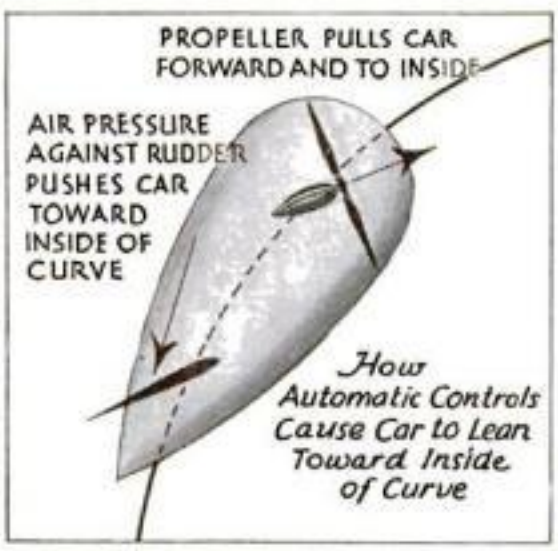
The mirror attached to this trap is supposed to trick greedy mice into taking the bait promptly

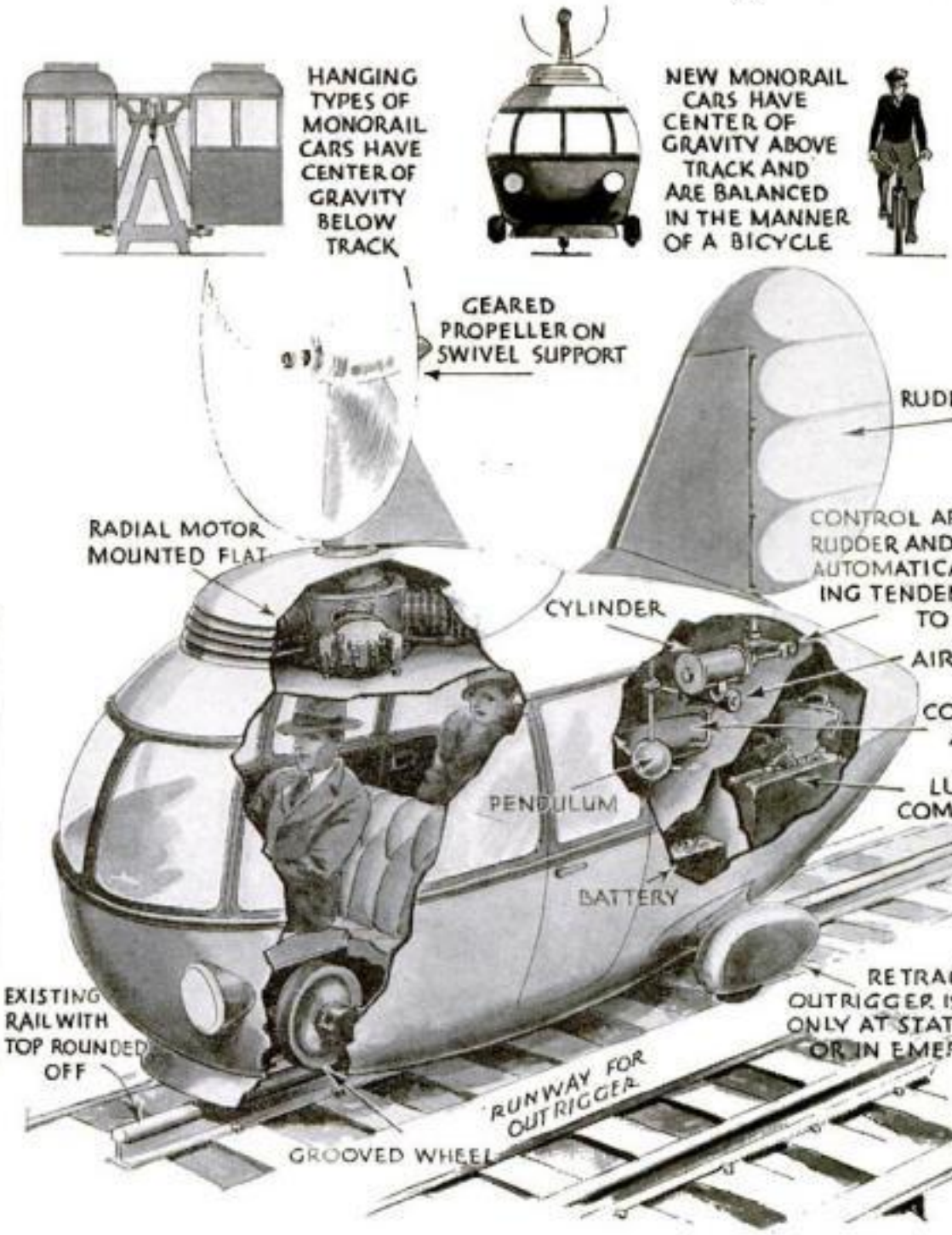
CAR HAS WHEELS IN DIAMOND PATTERN

WITH its four wheels arranged in a diamond-shaped pattern, a novel type of car proposed by Gabriel Voisin, French airplane builder, would have unusual maneuverability. The center wheels revolve idly upon a common axle. Single wheels at front and rear are used for steering, and operate interconnectedly. The motor, at the rear, drives the hindmost wheel. The model shown turns in very little space.

Monorail Car Rides Ordinary Tracks

Two Monorail Cars Can Use Existing Rails Of Standard Single Track





Drawings show artist's conception of the proposed monorail car that would operate on standard-gauge railroad tracks. The unique balancing mechanism is also shown

MONORAIL cars capable of using the rails of existing transportation lines are proposed by a Cleveland Heights, Ohio, inventor. Thus he would obviate the expensive new construction called for in many monorail projects, and would provide a self-propelled vehicle that could be used by railroads either to replace or to supplement regular trains.

Since the new car is designed to ride wholly above the supporting rail, some means is required to prevent it from toppling. The ingenious mechanism worked out by the inventor operates on the principle that a bicycle rider uses to remain upright. The air propeller that pulls the car is so mounted that it may be turned toward either side to counteract any tendency of the car to tilt, much as a man on a bicycle leans toward the inside of the curve in making a turn. An additional means of balancing is provided by an air rudder at the rear of the car. The two balancing devices are interconnected and operated automatically by a compressed-air mechanism, in response to the action of a sensitive pendulum that detects any deviation from an upright position. When the car stops at a station, outriggers on each side may be lowered to support the car on auxiliary wheels.

Even more similar in operation to a bicycle is a simpler form of the monorail car designed by the inventor for light traffic. Here the automatic balancing control is dispensed with and the driver balances the car with a hand lever resembling bicycle handlebars. In the smaller forms, either propeller or rudder may be omitted.

BOLT DRIVEN INTO STONE LIKE A NAIL

AN EXPANSION bolt just placed on the market can be driven like a nail into brick, stone or concrete. Made of spring steel, the bolt is slit for about half its length and the two sides forced apart to form a bulge. The end of the bolt is inserted in a hole drilled in the stone or concrete, and driven into place with a hammer. The bulging sides exert a tremendous outward pressure, holding the bolt firmly in place. It is made with several types of head.

TELESCOPE CAMERA MAKES LONG SHOTS

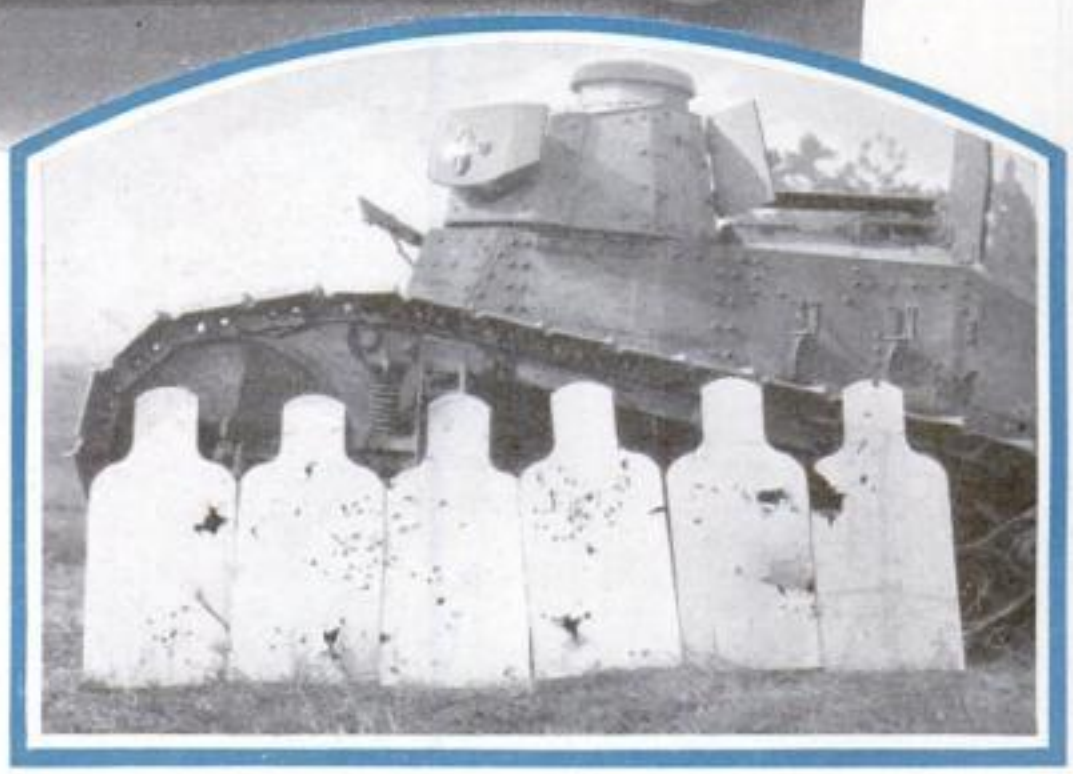
TO GET close-up pictures of mountain scenery from distant points of vantage, a photographer has constructed a camera resembling a telescope. Sliding cylindrical sections give it enough extension to accommodate a lens of four-foot focal length, which makes a remote peak seem only a few steps away. To hold the instrument steady in the wind, its owner has supplemented its standard tripod with a two-legged brace attached to the rear of the platform.

Long-range camera mounted on its novel wind-resisting base

Laboratory of Warfare

KEEPS OUR ARMY UP-TO-DATE

Soldier-Scientists Forecast the Doughboy of the Future by Tests of Everything He Will Use, from His Rifle to the Shirt on His Back



Col. R. H. Kelley with some of the equipment under test by the Department of Experiment. He is holding a dummy one-pounder shell drilled for economical target practice. In circle, gas mask that permits wearer to talk

The cardboard figures in the picture at the right show what modern armor-piercing machine-gun bullets would do to men in a World War model tank. They were used in a real test of the new anti-tank weapon

By THOMAS M. JOHNSON

IN HAZY Georgia sunshine, a soldier with a garden hose was sprinkling water on a blanket spread upon the ground. He was trying to soak it through and through. Presently, he looked up at two American flags floating overhead, one so faded that its blue had become gray, and its red, rusty salmon. With a pocketknife, the soldier cut a generous strip of cloth from each flag. Then he entered a low, wooden building.

Open-mouthed, I stared after him. Over the door, I saw a sign: "Department of Experiment."

I knocked, opened the door, and—instinctively—ducked.

"Tack-tack-tack-tack!"

The air within was filled with the raucous yammering of a machine gun. There was a machine gun in the room, too—but it was not firing. The deafening noise came from the hornlike mouth of a contrivance resembling a wooden coffee mill, with a ratchet and crank. An army officer was turning this crank enthusiastically.

"Is that an experiment?" I shouted.

The officer stopped turning the crank, and grinned.

"Not any more," he replied. "It works, as you can see—and hear. Makes target practice more realistic, and more practical. Sounds as if someone was shooting off thousands of dollars' worth of ammunition. For instance, if we use the light ray."

Deftly he touched the squat, heavy Browning machine gun. From it poured a stream, not of flame and smoke and lead, but of light—a slim, graceful ray, that shot across the room, filtered over a target, and then, under the officer's skillful guidance, came to rest on the bullseye.

The soldier on the left is wearing the new pack designed at Fort Benning. It gives a better distribution of weight than the old pack, seen at right

"Pretty good practice," he explained, "and costs almost nothing. That's our job here—experimenting with new ideas, gadgets, inventions."

"Then you're the fellows I want to see," I said. "The fellows who try out new wrinkles for the Army—if a well-conducted army ever has wrinkles."

"Well, seriously," said Col. R. H. Kelley, "the idea might shock an Inspector-General, but armies always have had new wrinkles. The chap who invented the stirrup, made possible the mounted knight who was king of the battlefield for nearly a thousand years. Then another ingenious cuss devised the musket, which blew the knight and his armor onto the scrap heap. Time after time, such new wrinkles have surprised and defeated superior forces, and changed the course of history. Sometimes, the surprise has been on American armies. Our job here is to prevent that happening again, by keeping abreast of every development of science and invention that will aid our national defense."

So, in time of peace, the Army is always tinkering, to keep its tools up-to-date, highly efficient, and sufficient in quantity for our small Army to learn the best ways of handling them.

To carry out that policy, Uncle Sam started the Department of Experiment as a part of the Infantry School at Fort Benning, near Columbus, Ga., and just across the Chattahoochee River from Alabama. There, on a reservation of 99,000 acres including every sort of country—mountains, hills, streams, marsh, sand—the Army is thinking up and trying out ways to do new things well, and old things better.

"Progress results from dissatisfaction," says Col. Kelley. So they sprinkle water on blankets of an ingenious new weave, to see if they really are waterproof; they expose to all weathers flags both of standard woolen bunting, and of a new fabric of rectangular weave—and find by test that cotton cloth is better.

The Department of Experiment is really a technical laboratory for testing all projects considered of practical value to the Infantry, and for originating new ones. At the time of my visit, there were thirty-five projects under way, including these:

Investigation of an airplane mooring kit for use as tent pins; protection of motor- and animal-drawn trains against aircraft and ground attacks; a cooling system for six-ton tanks; puncture-proof inner tubes; neckties—black, light tan, and khaki; movement by air of war-strength Infantry battalion; enlisted men's experimental packs; plans and specifications for a 1,000-inch small-arms range.

A new trick for using the light Browning machine gun against aircraft. Left, heavy machine gun equipped with light-beam device for bulletless target practice

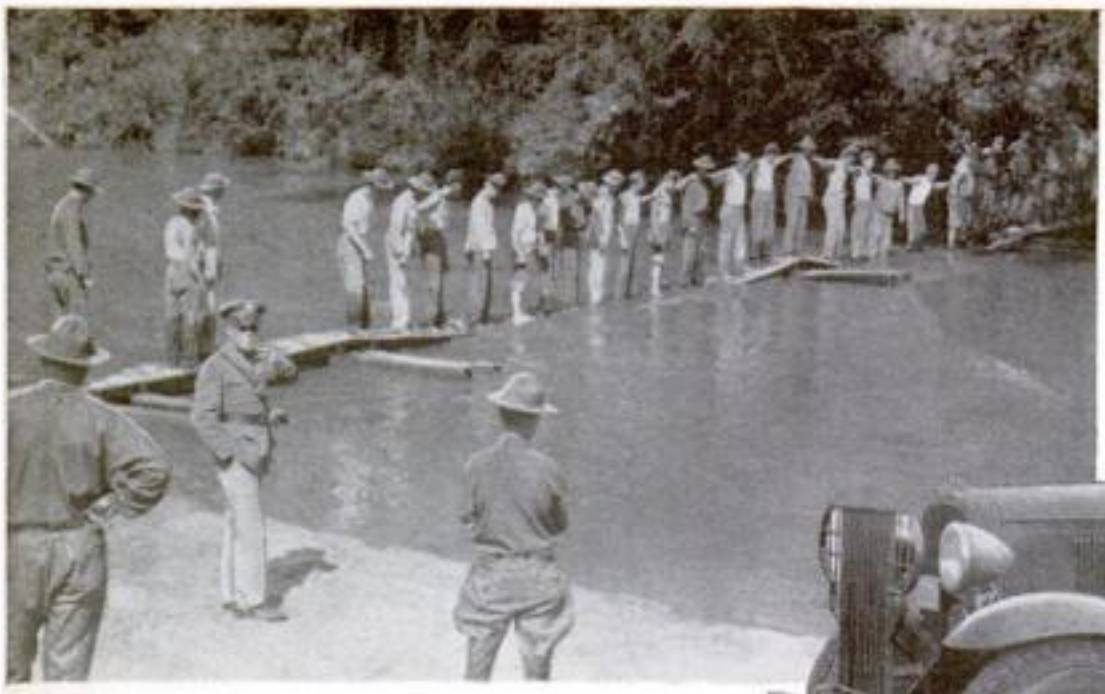
What the well-dressed doughboy will wear. Above, three views of the all-purpose combination hat and cap. Left, examples of evolution in trench helmets

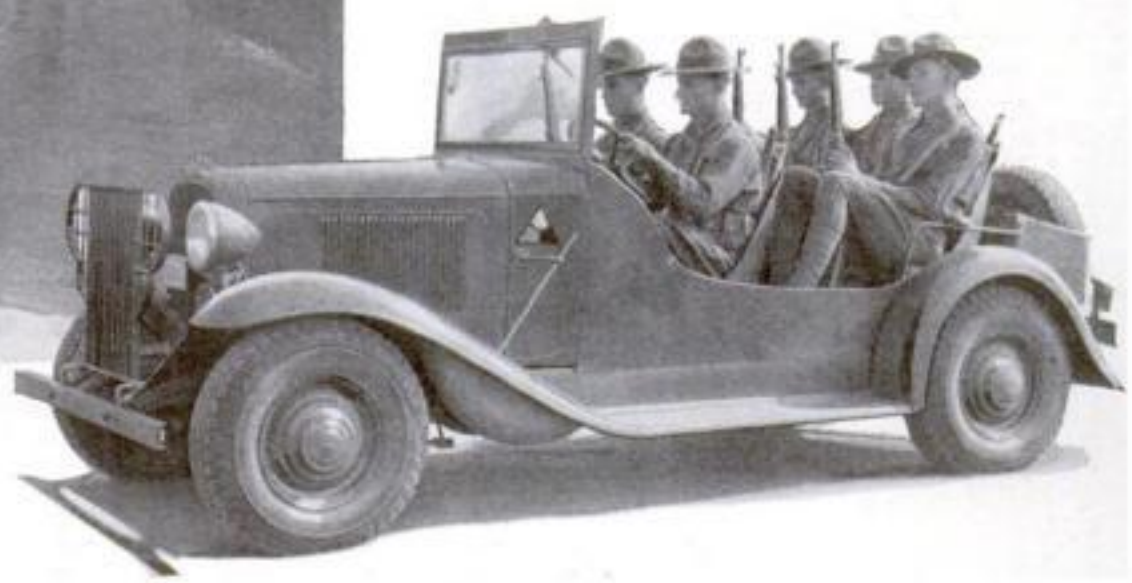
In this laboratory, the scientists are the director, Colonel Kelley, and Captains Negrotto, Ross, Burnap and Rarey; there are also nine enlisted men, specialists in various kinds of army equipment. The laboratory has nearly 5,000 guinea pigs with which to experiment—two Infantry regiments, the 29th and 24th, Artillery, tanks, and aviation. The doughboys of the 29th, especially, lead a varied and sometimes hectic existence, trying out other people's bright ideas. That new gas mask, for instance, with the canister tucked inconspicuously at the back of the wearer's neck; just try making a long hike half smothered in the face piece, with the canister bumping and chafing the base of your brain! "We'd rather get gassed!" say the boys of the 29th.

Eating waterless-cooker meals was not so bad. Neither was sleeping on experimental pillows of chicken feathers instead of the traditional Army cotton. As for the natty new "elastique" breeches and snappy laced knee boots, as veteran Sergeant Burns remarked, "They make a good-looking soldier look better."

"Benning," as the Army calls this odd experimental laboratory, is also a sort of military style show, with the doughboy demonstrating what the well-dressed soldier of tomorrow will wear. On his head he has neither the stiff garrison cap nor the broad-brimmed Stetson of imported rabbit fur, but a combination overseas cap and sou'wester, of domestic wool or cotton. It is light, and can be folded thin and flat to slip into a pocket. It looks jaunty, with brim turned up in back and down in front, to protect the eyes. Turn down the brim all around, and it shelters the ears and back of the neck. There may even be a new steel helmet, looking something like a brown derby, designed to prevent rocking on the head.

His shirt is no longer flannel, but serge, specially reinforced. His necktie may be blue for Infantry, red for Artillery, or yellow for Cavalry, instead of the traditional black. His breeches are "elastique", a soft, pliable corduroy; grayish in color,





NEW TRICKS FOR MOVING TROOPS

At the left, infantrymen are seen testing a portable footbridge designed for crossing streams under fire. Balsa wood was found to be best for the floats. Below, a standard automobile made into a scout car for open warfare

and lighter than his comfortable, roll-collared coat. Next summer he probably will wear yellowish khaki, shown by a three-months test to be fadeless under sun and rain.

On his feet, the doughboy will wear knee-length laced boots of tan leather, or perhaps a new woven cotton wrap puttee, and a new all-purpose shoe, with bellows tongue and rubber heels. These were evolved to replace the field shoe and the canvas legging that let dirt work into the shoe tops. For active service, Technical Sergeant Leroy F. Nicholson has proposed a loose jacket of blanket cloth.

Designs for new packs have been submitted by Sergeant Nicholson and Sergeant Walter S. Hurley, to save the doughboy from the bent back millions of his comrades have suffered from the present sausage-shaped pack. Both new packs ride high on the shoulders with center of gravity close to the body, so the wearer can stand straight. Including clothing, rifle, and pack, the soldier's load will be limited to a third of his weight, which is all he should carry. Soon the faithful guinea pigs of the 29th will be testing them out in hikes and maneuvres, day and night.

If the new pack makes a hit, the doughboy will no longer tote the half of a canvas pup tent for use in bivouac. He will lay a sleeping bag upon the ground, crawl in, and close the bag with a slide fastener. If he uses blankets, they will be of a new waterproof weave, looser but warmer than the old Army blankets and designed by a Quartermaster Corps officer, Captain Harry Kirsner. Even when he sleeps in a tent, the doughboy probably will not be "under canvas," but under twill. Tests show this material to be weatherproof, strong and sixty percent cheaper than canvas. One of the largest circus "big tops" is twill. Experimental cotton harness was very popular with the mules. They scented the straw lining, and ate it.

The infantryman in the field will have better food than before, and without the renowned rolling kitchen. Marching along with him will come his chow, boiling, frying, or baking on a new gasoline-burning stove carried on a truck, wagon, or anything handy. On the back of the stove, perhaps will be a contrivance that cooks vegetables and meats in their own juices without water, by means of tight-fitting heavy covers to keep in moisture. It has been proved unbreakable in tests.

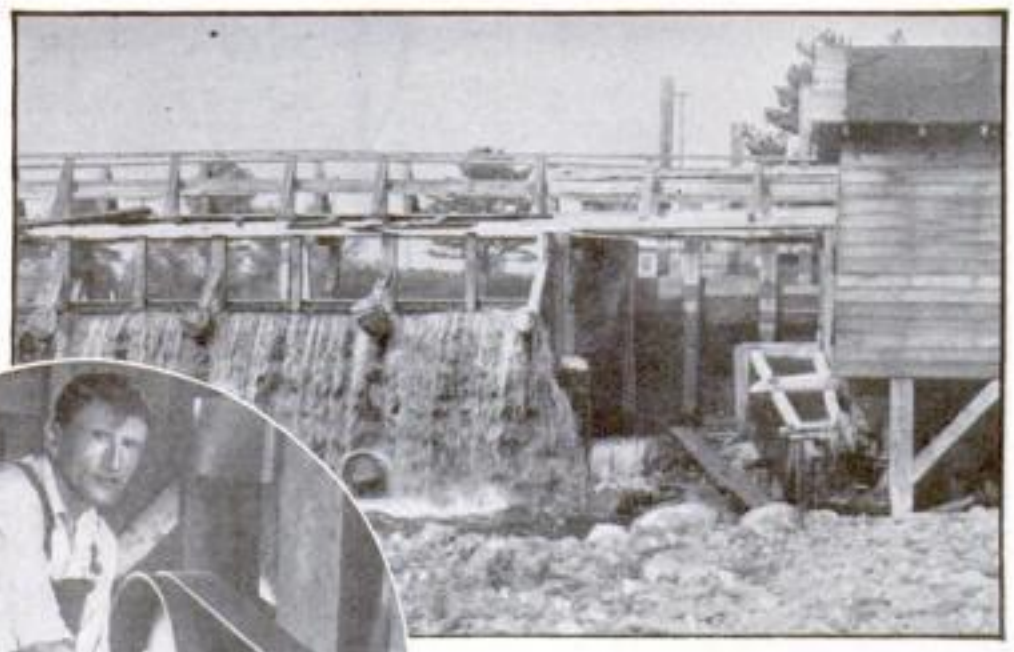
The old-time water wagon, too, is on its way out of the Army. Uncle Sam's Gunga Din will be a ten-gallon milk can in which water can be moved in any vehicle from truck to *(Continued on page 110)*

Tiny Power Plant Serves Nine Families

WHEN a Woodman, N. H., housewife wants to use her vacuum cleaner or listen to the radio, brother or sister runs down to the river and starts the municipal hydroelectric plant. The midget power station is believed one of the smallest in the world.

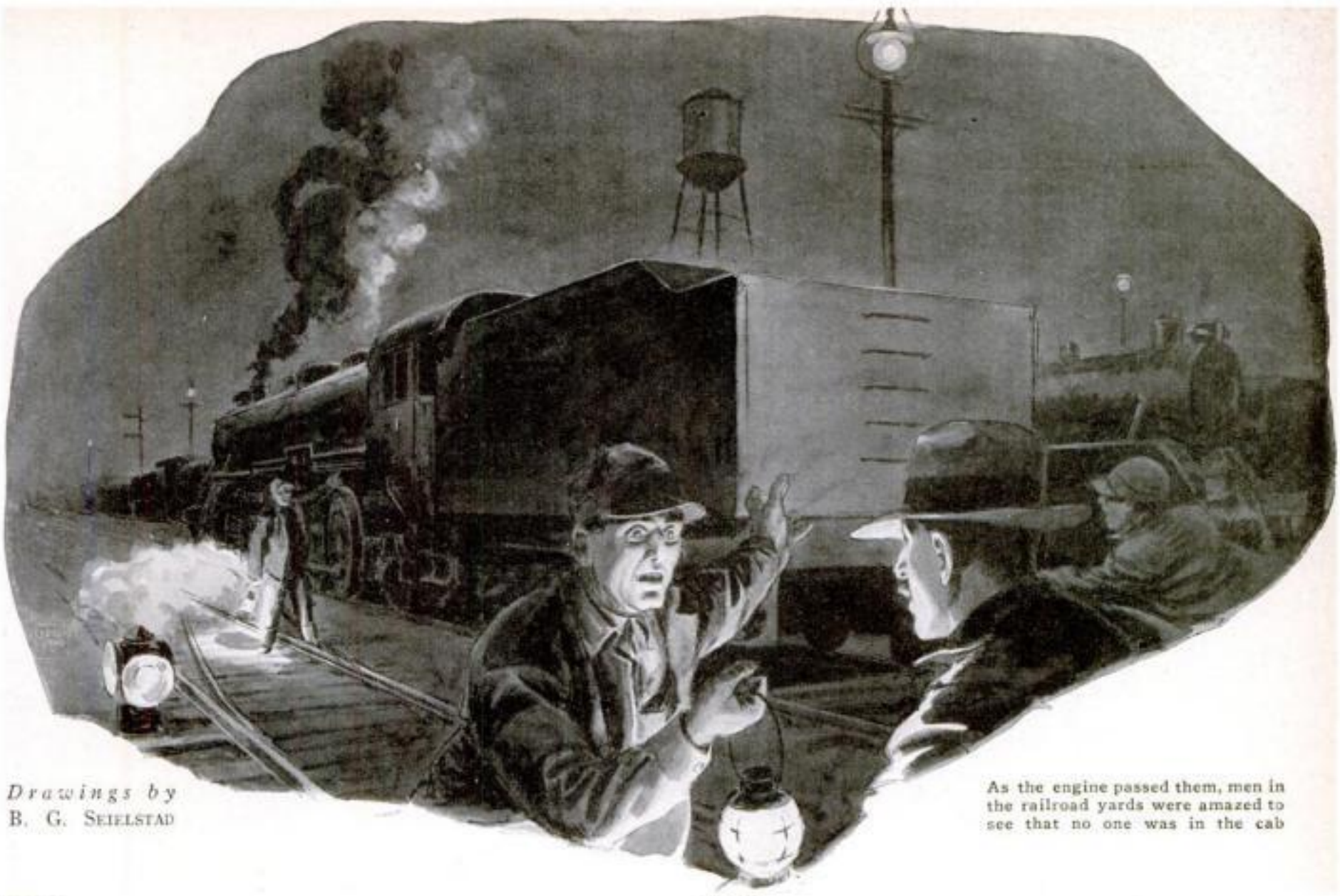
Some time ago the men of nine families of the neighborhood got together and built a dam across the Little Ossinee River, also erecting a power house that measured eight by ten feet. One of the group supplied a turbine wheel and generator. Poles, timber, and boards were cut from the land of the members. The men put up the poles and strung wires to their homes and to two community club rooms. Each family wired its own house to suit itself.

If a family wants light or power during the day, some one goes to the power house and presses down a two- by four-inch lever, taking a half hitch around it with a piece of rope to hold it down. This raises a gate and allows water to flow into the penstock and to the turbine wheel. Throwing off the hitch of rope drops the gate and stops the generator. After dark, the plant is usually in continuous operation. The consumers share equally the cost of maintaining the tiny station, the total expense amounting to about $1.25 yearly for each family. This also covers a tax of $6 a year collected by the town.



Dam and power house of the tiny hydroelectric plant which supplies current to nine families at Woodman, N. H. The plant was built by the coöperating group

Instead of the complicated switchboard of the ordinary power house, the Woodman plant uses this primitive control. Moving a bar admits water to the turbine and starts it



Drawings by
B. G. SEIELSTAD

As the engine passed them, men in the railroad yards were amazed to see that no one was in the cab

Sleepwalking Locomotives

PROVIDE A REAL RAILROAD MYSTERY

LOCOMOTIVES R3495 AND S3496 RUNNING WILD LAST NIGHT STOP UNEXPLAINED RUNS WITHOUT ENGINEERS STOP DETAILS FOLLOW STOP PLEASE SEND IMMEDIATE ASSISTANCE

FANTASTIC tales abound in the lore of railroad men. Rich in romance are the yarns that are spun wherever old-timers gather to swap their experiences. But it would be hard to find one stranger than the true mystery story behind the telegram reproduced above—a story, the events of which took place so recently that their details are fresh in the minds of witnesses.

The original of this startling telegram now reposes, along with hundreds of less exciting documents, in the files of one of America's great locomotive-building corporations. It was an urgent call for aid from a southeastern railroad, for strange things were happening in the line's yards at Atlanta, Ga.

Locomotives were *walking in their sleep*. Smoking monsters, weighing hundreds of tons, were coursing along the tracks by night, with empty cabs and untended throttles. This was the astounding story with which a baffled railway superintendent met representatives of the locomotive firm, who answered his call for assistance. Under their close questioning, he supplied the details leading up to the mysterious happenings.

LOCOMOTIVES that walked in their sleep at Atlanta, Ga., not long ago, furnished one of the most amazing of true mystery stories in railroad history. The author of this article, a locomotive patent expert, tells how engineers acted as sleuths to solve this mystery

The two locomotives in question, R3495 and S3496, had been "put to bed" after finishing their runs the evening before in accordance with the usual practice. In other words, they had been run into a shed, their throttles closed and locked, their boilers filled with water, and their fires banked. The engines had thereupon been left to remain "asleep" until their next scheduled runs the following day.

By
EDWIN M. MARTIN

About four o'clock in the morning, men in the railroad yards saw Locomotive R3495 emerge from its shed and start, first slowly and then with increasing speed, down a track leading out of the yards. This, they knew, was not according to schedule. Their surprise gave way to amazement as the engine passed them and they saw that there was no one in the cab. The locomotive was walking in her sleep!

No wonder these sober railroad men could scarcely believe their eyes! Here was a phantom such as might have been drawn from the pages of fiction, suddenly materialized into the brusque reality of cold steel and whirling drivers.

Out of the yards and down the track, luckily clear, sped the locomotive. Had this been fiction, perhaps the 140-ton Juggernaut would have wrecked a train carrying villainous rivals of its owner. This was not fiction, but what did happen was just as inexplicable. After several miles of somnambulistic travel the locomotive slowed down and stopped, with no more apparent reason than it had had at the start. Now it is to be noted that

The locomotives were chained to the track, as a crude expedient to keep them in the shed

locomotive S3496 was looked upon as the sister engine to R3495. The two were of the same type and had been put in service at the same time, on similar schedules. S3496 had been put away for the night on the same track, and almost at the same time, as its sleepwalking sister. Now it supplied the climax of the nocturnal drama.

Before the men in the yards had recovered from their surprise at the first runaway engine, S3496 rolled out of the shed—without a man aboard—and disappeared down the track in apparent pursuit. To complete the episode, it pulled up and stopped just behind the first locomotive, as if to keep some clandestine rendezvous out there in the darkness.

In short order, the runaway engines were manned and brought back safely into the yards. The mystery of their behavior, however, remained unexplained.

SPECIAL engineers were assigned to stay in the cabs of the engines at all hours and to report any unusual happenings. During the nights that followed, the eerie drama repeated itself regularly. A few hours after they had been "put to bed," both locomotives would mysteriously start to move; constant vigilance on the part of their keepers was required to stop them.

Every precaution, of course, was taken. The throttles were more securely locked at complete shut-off each night, without avail. Examination showed the throttle valves in perfect condition, and ruled out the simple explanation that leaky valves accounted for the engines' sleepwalking proclivities. Eventually, a crude but effective expedient was adopted to keep the locomotives in their shed—they were chained to the tracks!

No railroad cares to have untended locomotives running loose on its tracks, nor does it want to have to keep them chained up to prevent it.

In its embarrassing predicament, the line apparently was dealing with engines that had developed human powers of moving when they desired, and habits of taking secret excursions into the night.

But railroading is built upon science and hard facts; therefore mystery could be given no place in this enterprise. With only such romance as is derived from equations and formulas, in their plain small office, the locomotive builders set to work with their slide rules and charts. And in their usual matter-of-fact way, after many hours of careful calculation, they at last announced that the problem was solved. As with other apparent mysteries, it all seemed simple enough when the solution was known; yet arriving at this solution involved an elaborate piece of scientific detective work.

To understand just what happened, we must look inside one of the locomotives. Because the two were virtually identical in design and use, a description of one applies equally to the other.

In general, R3495 conforms to the usual design of steam locomotives, as shown in the accompanying diagram. Steam is generated by fire tubes passing through the boiler, and is collected in a steam dome. Here a throttle valve, when opened, admits the steam to a conduit known as a "dry pipe," and through this pipe the steam flows to the cylinders and drives the locomotive. Any passage of steam through the throttle valve, whether from leakage, incomplete closing of the valve, or any other cause, would cause the locomotive to move forward without human control.

Hence, interest was centered upon the operation of the R3495's throttle. They checked each of its interconnected parts, shown in the diagram: the throttle lever in the cab; a rigid reach rod, extending forward; a bell-crank lever, pivoted to the "dry pipe," serving to transmit the motion of the reach rod to a pair of vertical rods; and, finally, the throttle valve itself, open when raised and closed when lowered. All were found in perfect order.

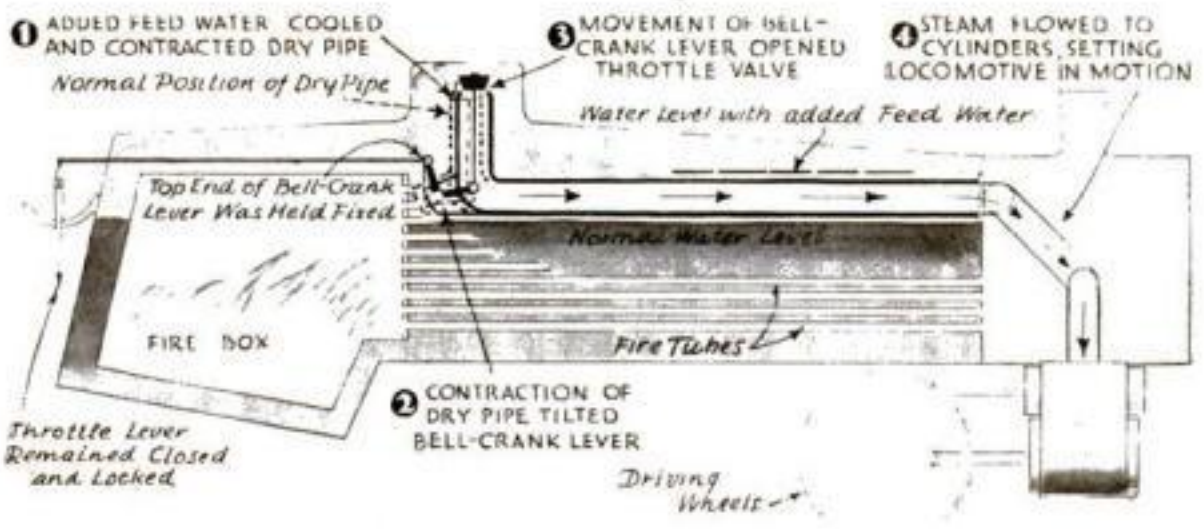
Investigation showed that the water level in the boiler was normally at the bottom of the dry pipe. When the engine was called in, however, more water was customarily added to the boiler, raising the level above the dry pipe. Here was the first significant clue. The normal running temperature within the boiler was 388 degrees F., and, therefore, this was also the normal temperature of the dry pipe. The feed water added when the engine was run into the shed was at 199 degrees F., or nearly 200 degrees cooler. Taking into account these facts and the length of the dry pipe, which was eighteen feet and two inches, the engineers began calculations that led to the following solution of the enigma:

WHEN the locomotive was housed for the night, the addition of the cooler water had no immediate effect; but in due time it lowered the temperature of the dry pipe. In accordance with a well-known law of physics, the pipe contracted as it cooled, and the drop in temperature of nearly 200 degrees caused a total contraction of considerably more than an inch. The effect was to draw the rear end of the pipe forward by more than one inch.

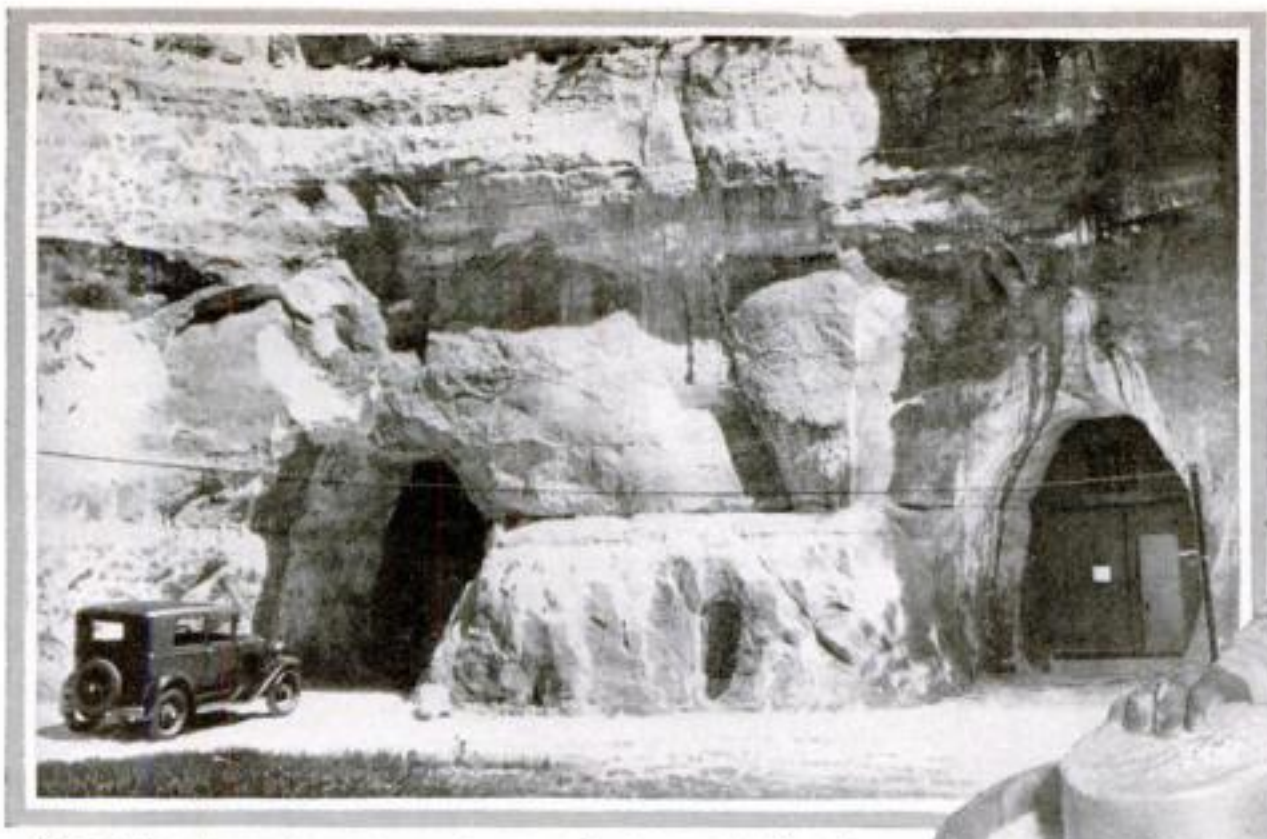
Because the bell-crank lever operating the throttle valve was mounted on this pipe, it also was drawn forward. However, the top of the bell-crank lever could not move, because it was attached to the locked throttle lever. Hence the whole bell-crank lever was tilted, the throttle valve was raised, steam flowed into the cylinders, and the engine began moving.

On the first night of its sleepwalking, R3495 had been supplied with more feed water than S3496. This explained why it started before the other on its mystery trip; its dry pipe contracted more rapidly than that of its sister engine. Both locomotives stopped when they had used up the relatively small amount of steam that is carried in the boiler under such conditions. Luckily the second engine halted before it could collide with the one that preceded it on the same track, or the story of the runaway locomotives might have had a more serious conclusion that it did.

Once the mystery was solved, it was a simple matter to provide a new support for the bell-crank lever, independent of the dry pipe and on a part of the boiler in which it would not be affected by expansion or contraction. And the railroad men breathed sighs of relief when they knew that the sleepwalking pranks of the sister locomotives were stopped.



Drawing shows the solution found by engineers for the mystery of the sleepwalking engines



This picture shows two entrances to caves that are naturally air-conditioned for the ripening of Roquefort-type cheese just as in France

First, the proper mold **is put** to work within the **cheese.** Salt checks surface **growths**

CAVES FOR Cheese Making

DISCOVERED IN AMERICA

BECAUSE an observant scientist noticed heavy rust on a lantern, during a chance visit to a mushroom-grower's cave, American dairymen may now produce a cheese that is said to vie in flavor with the prized Roquefort of France. The telltale rust convinced Prof. W. B. Combs, of the University of Minnesota, that sandstone caverns of the Mississippi River bluffs matched European caves in providing just the right temperature and humidity for ripening this delicacy. As a trial, he had 10,000 pounds of Roquefort-type cheese prepared from cow's milk and ripened in one of the caves. The experiment, it has just been announced, has been completely successful, yielding a product of fine flavor, and consequently, Prof. Combs concludes that Minnesota alone can produce as much Roquefort-type cheese yearly as the whole country now imports.

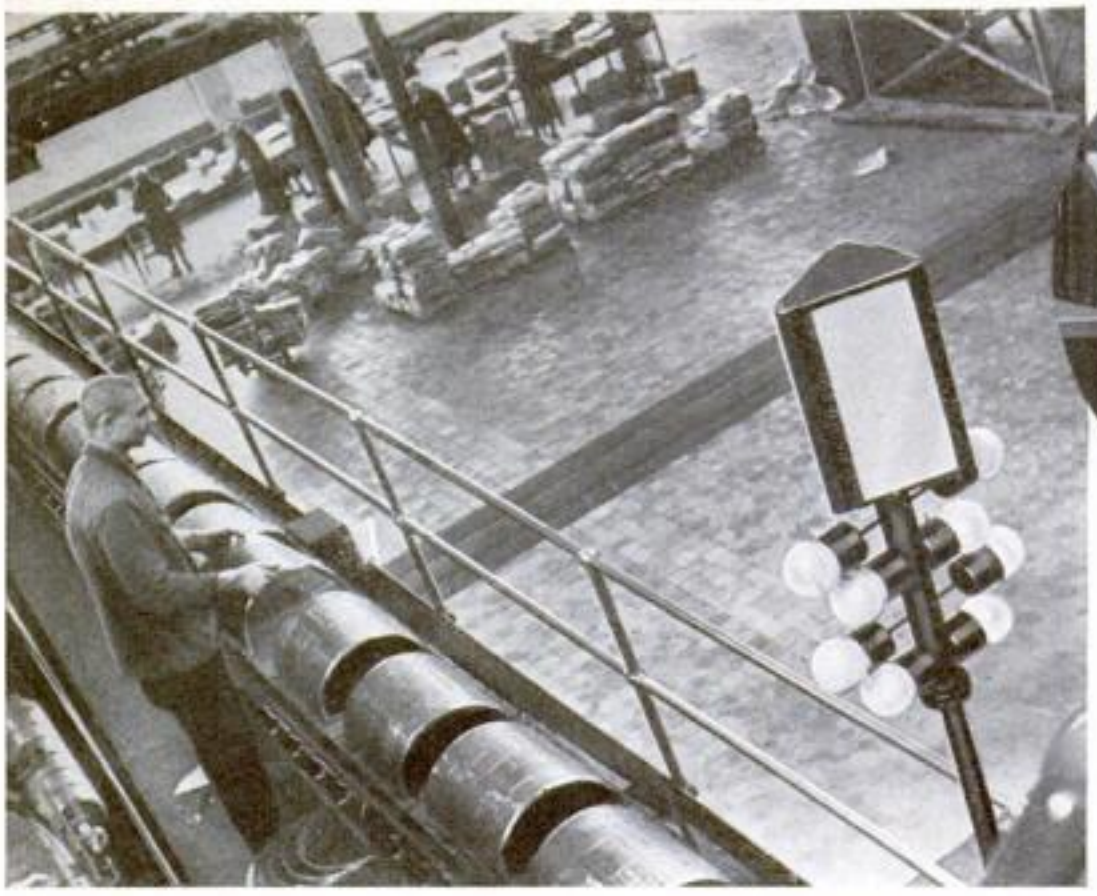
What makes this project commercially practical is simply that the natural caves remove need for expensive air-conditioning; for no mystery of climate or geography determines what cheese can be made. Nature need not even be depended on to provide the particular bacteria and molds that help develop the flavors of various types, because government agencies now supply pure cultures of the organisms. Only slight variations in the fundamental processes of cheese-making—curdling the milk, cooking, salting, and shaping the curd, and ripening the new or "green" cheese—are needed to produce all the 400 or more named varieties of cheese.

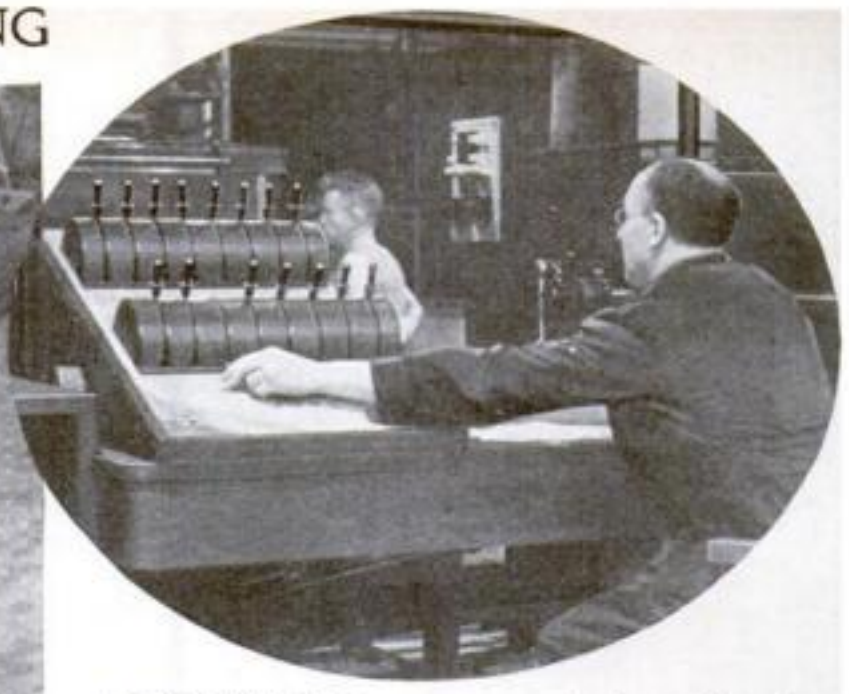
Above, scraping to resist further the unwelcome external fungi. In the meanwhile, the blue-green veinings of typical Roquefort are developing within. Left, machine punching tiny holes that admit air to speed ripening

Testing for maturity, in the cave. The flavor improves as the mold increases

Common American cheese owes its mild flavor to being placed in cold storage almost as soon as made. Swiss cheese, in contrast, is ripened for weeks or months in a warm cellar to favor development of gas-forming bacteria. Camembert, Stilton, and Roquefort are among the varieties that derive their piquant flavor from molds; the greenish-blue mold of Roquefort is cultivated on moist bread, dried, and sprinkled with a salt shaker between layers of the new cheese as it is shaped in hoops. An expert can tell from the sound made when a Swiss cheese is tapped, whether it is yet mature.

TRAFFIC SIGNALS SPEED PRINTING





Signal lights, shown above, tell Russian pressmen which plates are on their way from the stereotyping shop. Right, operator at switchboard controlling the signal system

TRAFFIC lights are a recent innovation in a great Russian newspaper plant, where they speed up the work of handling the plates from which the paper is printed. These curved metal plates are cast in a stereotyping shop and are transported to and from the big rotary presses on an endless conveyor. The light signals, and a warning siren, advise the press tenders which plates are on the way. An operator at a switchboard in the stereotyping shop controls the signals. Frequent changing of plates makes such a system highly valuable.

BURGLAR ALARM GUARDS LOAD ON MOTOR TRUCK

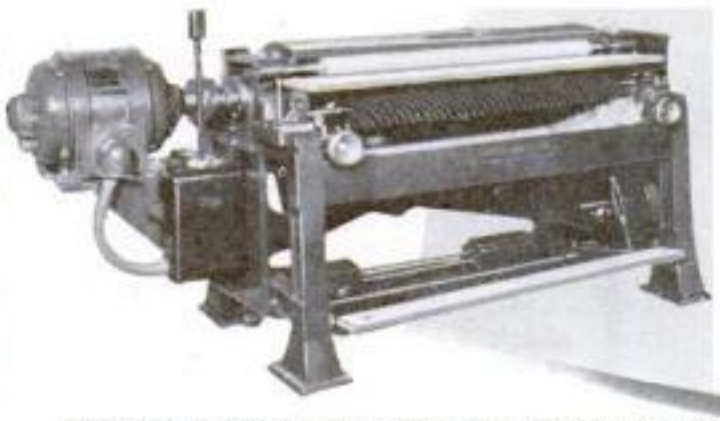
AN AUTOMATIC burglar alarm for motor trucks, recently placed on the market, turns on an ear-splitting siren and locks the ignition in "off" position if the door of the driver's cab is left open beyond a predetermined time. Locked at the dispatching point, the alarm can be unlocked, to permit unloading, only by the agent at the receiving end. The driver merely inserts a key in a dashboard control box, shown above, and manipulates certain buttons on entering and leaving the cab. If he varies the procedure in any way, the alarm sounds a warning immediately.

FLASHING NEON LAMP TESTS IGNITION

A NEW instrument, shown at right, for checking the timing of a car's ignition system, contains a neon lamp that flashes simultaneously with the spark in the cylinder. If the timing is accurate, a mark on the flywheel appears to stand still. If not, its position with reference to a second mark on the flywheel housing, shows if the firing is too early or too late. By special procedures, it is also possible to synchronize double points.

MACHINE SHAVES PRINT FROM PAGE

A GRINDING machine so precise in its operation that it can shave the print from a piece of newspaper or a magazine page, without cutting through or tearing the paper, has just been introduced to industry. Its makers estimate that this mechanical marvel can be adjusted, if desired, to take off a slice only one thousandth of an inch thick, or thinner than a human hair. The new machine, run by a small electric motor, is intended for use by glove makers. Its fifty-inch grinding roll will be used for shaving tanned hides to the exact thicknesses required for the delicate materials of which women's gloves are made. With this equipment, many hides that would otherwise be made up into shoes or men's gloves can be worked to the thin finish.



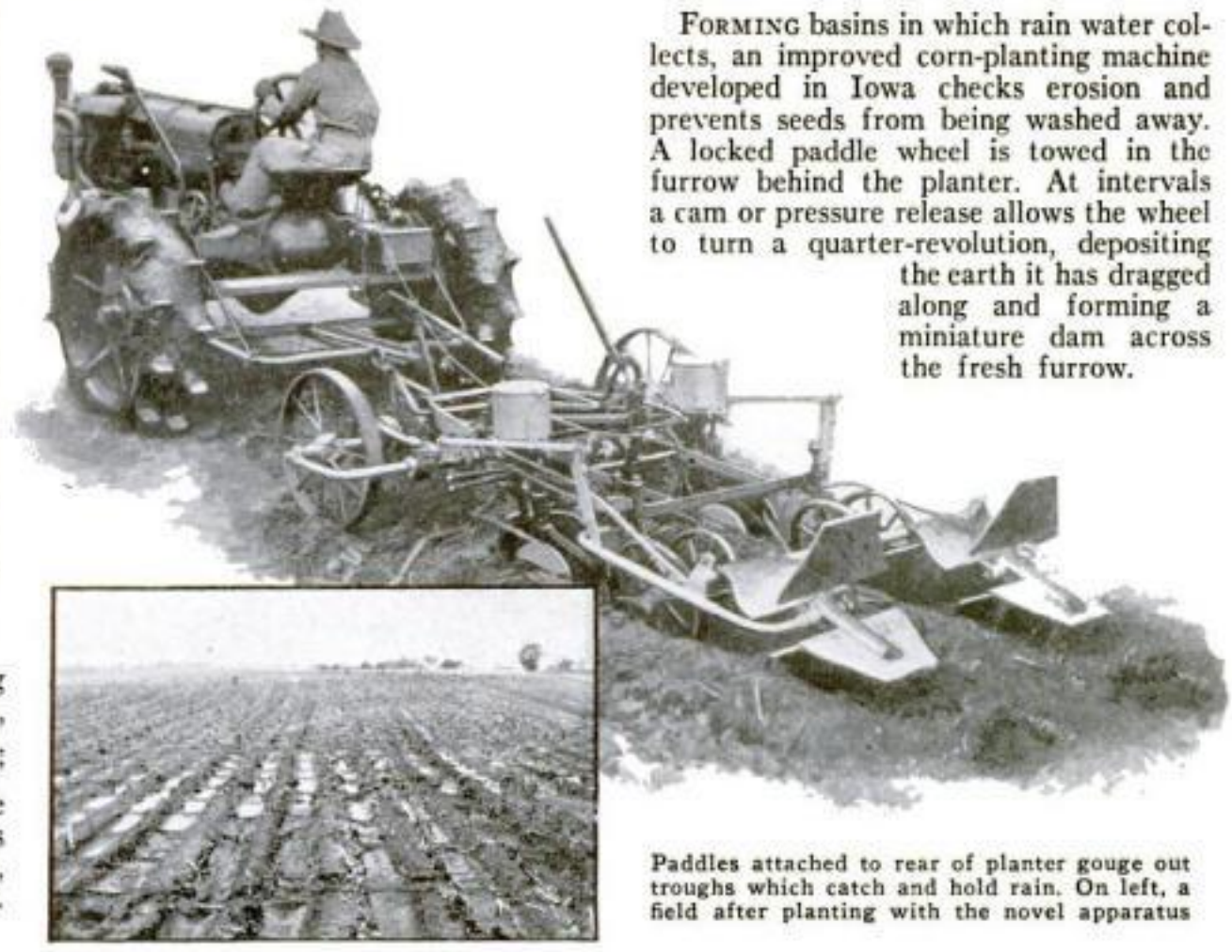
Above, machine which removes hair-thin layer of paper or leather. Right, surface shaved from part of a page of printed matter without cutting or tearing the paper

HARNESS HOLDS CROOKS

To PREVENT prisoners from escaping while being transferred from jail to court, an inventive deputy sheriff of Portland, Me., has devised a "handcuff harness." Wristlets confining the prisoner's arms are attached to a belt, restricting his motions so that he cannot balance himself to run, although he can walk without difficulty. The picture shows it being tested.

PLANTER PREVENTS WASHING OF SEEDS

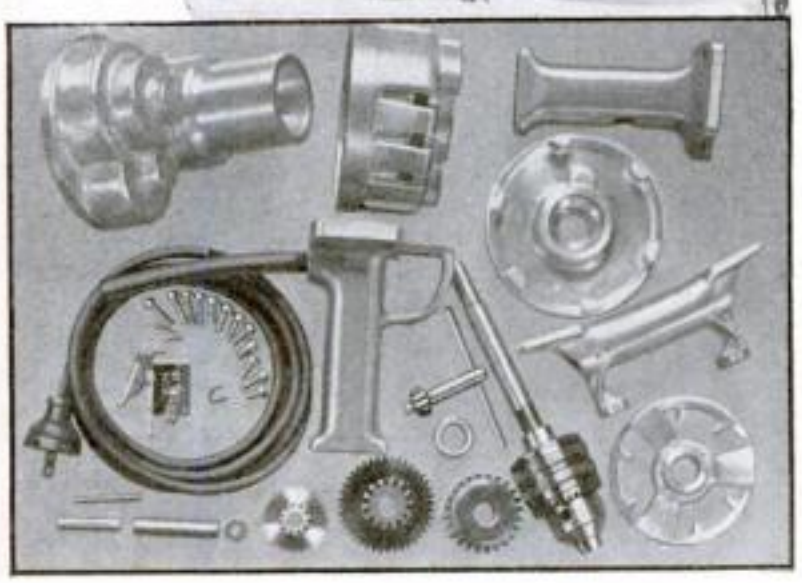
FORMING basins in which rain water collects, an improved corn-planting machine developed in Iowa checks erosion and prevents seeds from being washed away. A locked paddle wheel is towed in the furrow behind the planter. At intervals a cam or pressure release allows the wheel to turn a quarter-revolution, depositing the earth it has dragged along and forming a miniature dam across the fresh furrow.



Paddles attached to rear of planter gouge out troughs which catch and hold rain. On left, a field after planting with the novel apparatus

KIT MAKES DRILL OF OLD GENERATOR

An old auto generator and the parts shown in lower photo enable workshop fans to assemble this economical electric drill



WITH the aid of a kit just placed on the market, an amateur mechanic can build his own electric drill, using an old automobile generator of the Ford Model T type for power. A suitable generator, which the maker declares can be obtained for a nominal price at almost any junk yard, is revamped and used as a motor with either 110-volt alternating current, 110-volt direct current, or thirty-two-volt direct current. The other parts, which include a standard type of three-jaw, half-inch-capacity key-type chuck and a double-action trigger switch, are then assembled. The completed drill is said to have a great variety of uses in the home workshop.

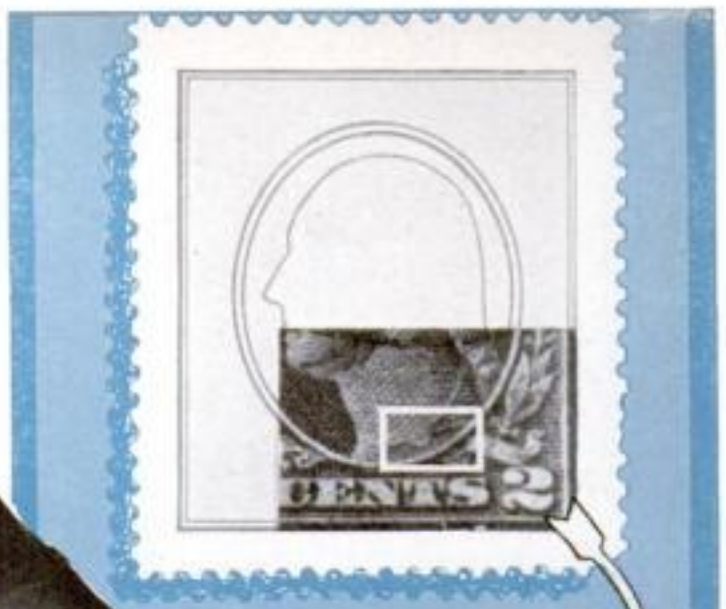
YACHTS AND FISHING BOATS GET RADIOPHONE

CAPTAINS of fishing vessels, harbor craft, and yachts may call their homes or offices as easily as if on land with newly developed radiophone equipment and service. The user picks up a 'phone, as in the top photo, presses a button, and says, "Marine Operator." A voice ashore replies, "Number, please," and the call is completed in routine fashion. Any shore station providing the service may also call the boat. The equipment, shown in the lower view, uses the same antenna for sending and receiving of messages.

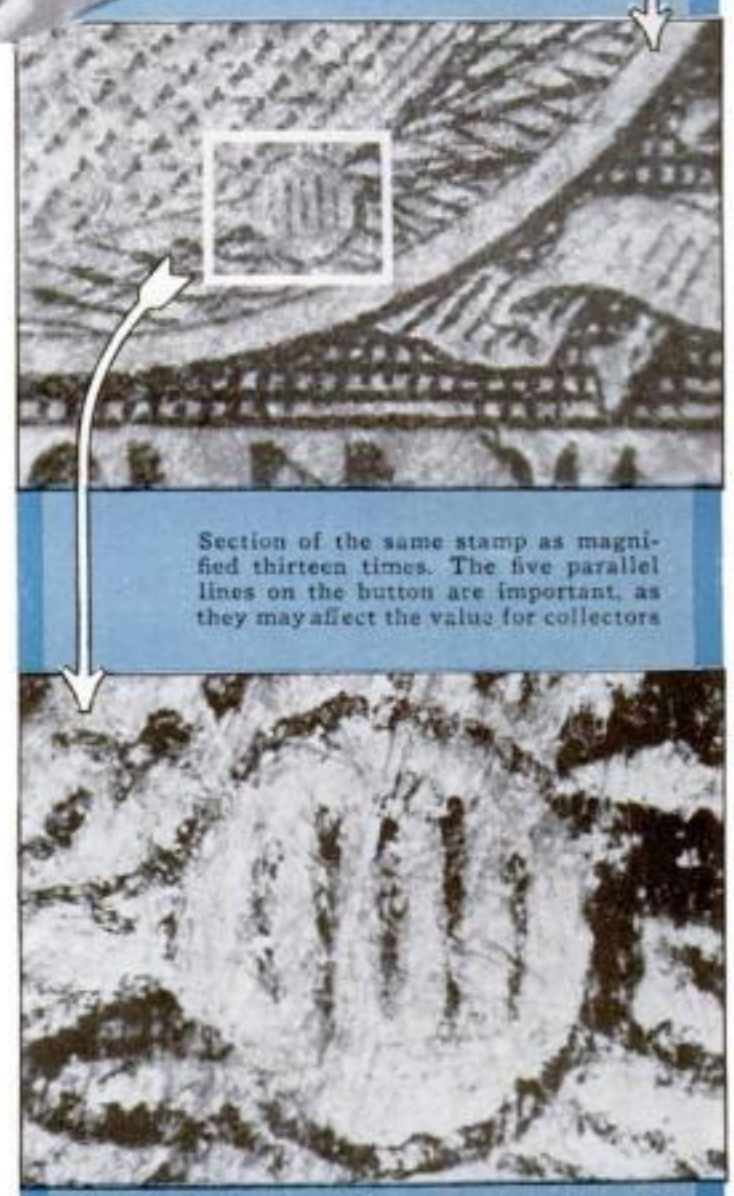
ONE MOTION OPENS SUIT CASE

LATCHES at the center and at both ends of a new traveling bag, shown at right, are released simultaneously by pressure on a single button at the center. The button is combined with a five-tumbler lock of cast aluminum, operated by the owner's automobile door key. This removes the need of carrying two keys, and simplifies the task of locking the bag to protect its contents against the activities of the petty thief. Its chief virtue, however, is the ease with which it is opened. All tussling with locks and latches is eliminated.

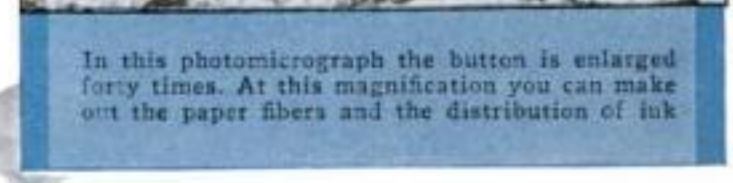
An ordinary lamp, with shaded bulb, being used in examining stamps and coins. This simple lighting is sufficient



A section of a two-cent United States postage stamp magnified four times. Note the button on the toga worn by the figure



Section of the same stamp as magnified thirteen times. The five parallel lines on the button are important, as they may affect the value for collectors



In this photomicrograph the button is enlarged forty times. At this magnification you can make out the paper fibers and the distribution of ink

STAMPS and Coins

Under Your Microscope

UNDER the naked eye alone, coins old and new have an alluring glint for the collector. Stamps, too—pictorial stamps from all over the world—have their strange glamour for him, as he spreads them out on the table before him.

But when he adjusts the mirrors of a compound microscope and peers through the eyepiece at one of his treasures, he begins at last really to see and to enjoy the charm of remarkable details otherwise invisible.

Even if you are not a collector, you can, for one cent, buy several hours of fascinating entertainment. First, use the penny as a specimen for your microscope; then go to the post office, buy a one-cent stamp with it, and spend another evening exploring the mysteries of that bit of paper. You will learn facts about coins and stamps that you never before suspected.

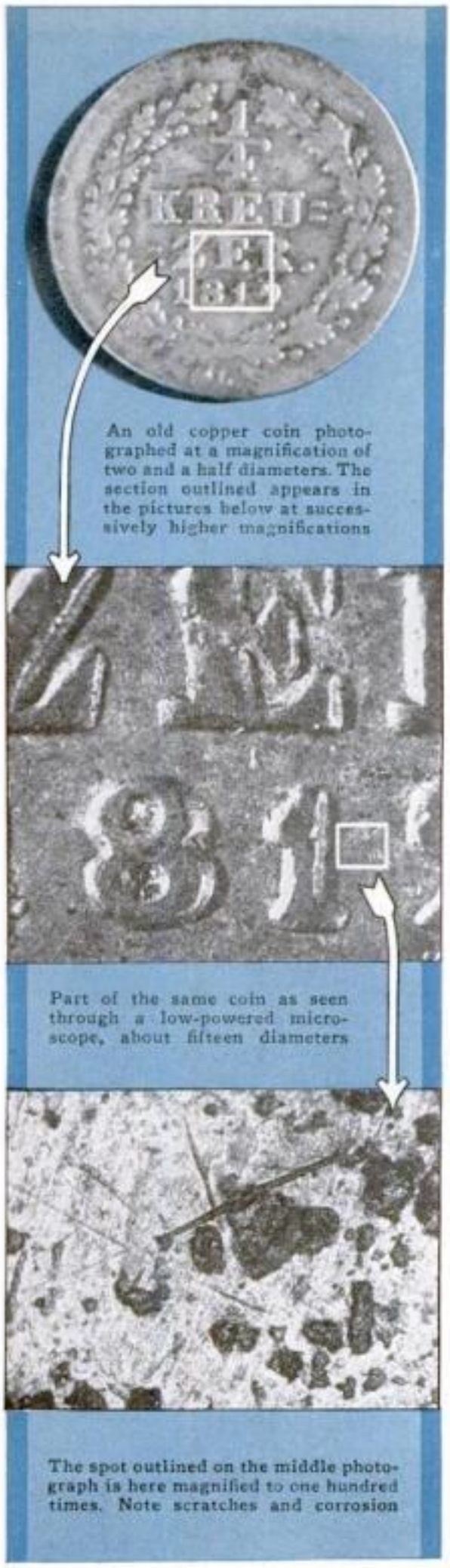
For the study of stamps and coins, almost any microscope capable of giving clear images is suitable. Low magnifications, from ten to forty diameters, are more useful than higher ones. Perhaps the best instrument for the study of such specimens is a binocular microscope of the Greenough type, but this seldom is available to amateurs.

Because a coin is not transparent, it must be viewed by reflected light; that is, light falling on it from above or from one side. Such lighting as this is not difficult to arrange, particularly with the low or moderate-power microscopes. Simply to place the microscope before an open window, will, in many cases, be sufficient. At night, the coin can be illuminated by a sixty-watt lamp close to the microscope stage and somewhat above it, and equipped with a shade for keeping direct rays from the eyes.

A LIGHTING TRICK

Microscope with substage mirror placed above the stage for examining coins and stamps

Many amateurs' microscopes are fitted with a substage mirror that can be removed from its customary place below the stage and attached, by inserting its mounting pin into holes drilled in the microscope arm, at one or more points above the stage. The mirror may then be tilted until it throws a beam of light on the coin. If you have a miscroscope illuminator equipped with a concentrated-filament bulb and a con-



densing lens system, you can direct a light beam of the desired intensity and color across the coin, using the above-stage mirror as an aid for illuminating the shadow side of raised designs.

In general, light falling across a coin almost horizontally will create sharp shadows and considerable contrast, but light falling from above, as it does when a vertical illuminator attachment is used between objective and eyepiece, will give virtually shadowless lighting. Each type has its advantages, although for most work, sharp shadows should be avoided.

Frequently, details cannot be seen as plainly as desired, because of bothersome reflections from highly polished areas, because of discolorations, or other reasons.

Unsuspected Wonders Found in Ordinary Coins and Stamps by Examining Them at Relatively Low Magnification and with Simple Lighting

By MORTON C. WALLING

When coins, metals and the like are photographed without cleaning, polishing or coating, such details sometimes cause trouble.

A method frequently employed in such cases is to coat the surface of the coin with a thin layer of ammonium chloride. This is a white substance, which can be laid down in so finely divided a state that minute scratches and similar details are painted over without being concealed. Sometimes such articles as shells and fossils, which are to be inspected with a microscope, are given the ammonium-chloride treatment to bring out details of structure otherwise invisible.

To coat a coin with ammonium chloride involves the building of a simple generator from three bottles, some glass tubing and a few pieces of rubber hose fitting tightly over the tubing. The bottles must be equipped with tight corks. Bore two holes in two of the corks, and three in the other, to receive the glass tubing. Cut and bend pieces of glass tubing, insert them through the corks, and connect the parts with rubber hose as shown in the illustration. One of the bottles, the one with the three-holed cork, serves merely as a safety trap. Air forced into it travels through the hose and bent glass tubes to the two other bottles, the outlet ends of the tubes being near the bottoms of these bottles. The glass nozzles projecting from these bottles have their inside ends flush with the bottoms of the corks. In one bottle, place a small quantity of concentrated (fuming) hydrochloric acid. In the other, place a similar amount of strong ammonia water.

You can force air into the first bottle or trap with a rubber bulb or by blowing through a piece of hose attached to the glass inlet tube. This air moves into the bottles containing the acid and ammonia, bubbles through these liquids, and emerges through the nozzles, heavily charged with ammonia and acid vapor. The openings of the nozzles touch. As soon as the vapors emerge, they combine to form the smokelike ammonium chloride. Although the air trap is not necessary, it is advisable because it prevents acid and ammonia from being sucked into the mouth accidentally, and from being forced backward by sudden release of pressure.

Coins, to be coated, should be perfectly clean. Scrubbing with soap and water is sufficient. Lay them on a flat surface and turn over them a clean tin can in one side of which, near the bottom (the top, when it is over the coins) a hole has been punched. Insert the nozzles of the ammonium-chloride smoke generator into this hole. A few puffs of air through the generator will fill the can with dense, grayish white smoke. Allow this smoke to settle for three or four minutes, and then blow in another smoke charge. Continue until the desired coating has been built up. Avoid excessive deposits. A thin, grayish white coating is desirable.

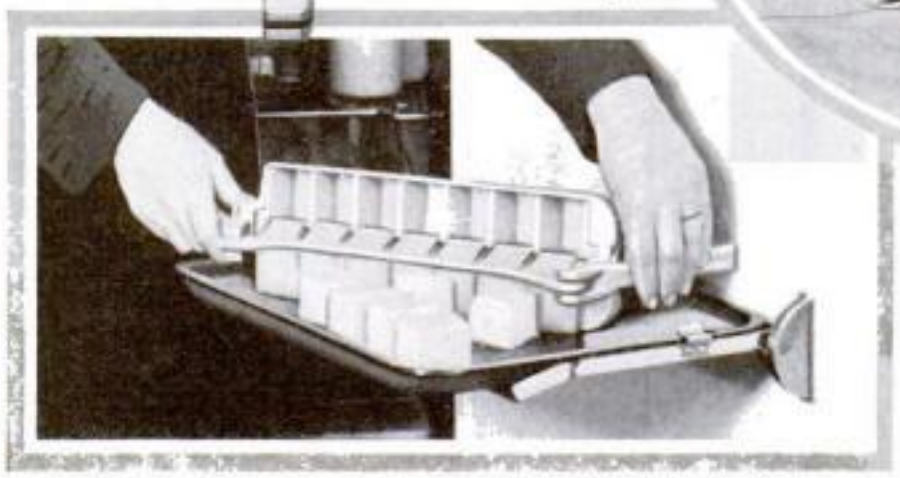
Care must be taken to prevent too much acid vapor from entering the can and settling on the coin. Copper coins, particularly, may be damaged in this way. Better try the scheme first with a common penny. As soon as you have completed your examination, wash the ammonium chloride off with water. Flaking of the deposit generally indicates that the metal is being attacked by acid droplets. To make sure that *(Continued on page 96)*

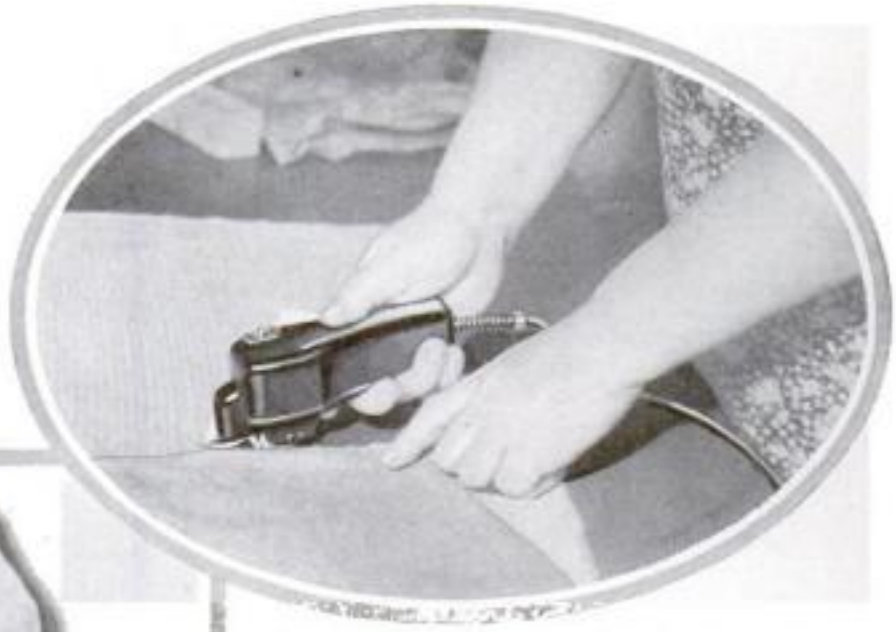
GENERATING AMMONIUM CHLORIDE FOR COATING DISCOLORED COINS

With the simple apparatus shown here, you can generate ammonium chloride and deposit it on coins that are too discolored to photograph in their natural state. The old copper coin reproduced at the left has been partly coated by this process to show the effect

New Household Utilities

AN ULTRA-MODERN REFRIGERATOR. The revolving shelf in this new refrigerator makes food more accessible. It turns at the touch of a finger. When returned to its normal position, it is held securely in place by an ingenious automatic locking device





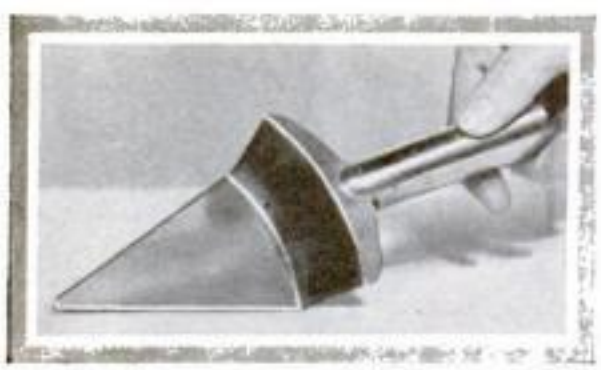
ELECTRIC SCISSORS. Designed on the principle of barbers' clippers, these new electric scissors will cut the most delicate chiffon or the heaviest blanket material without a slip

CRUSHES ICE CUBES. Turning ice cubes into crushed ice is an easy task with the device shown above. One or two cubes, placed in an ordinary kitchen glass, are crushed with a few downward strokes

ICE-CUBE EJECTOR. Another novel feature of the refrigerator shown above is this mechanism for ejecting ice cubes from the tray without the nuisance of holding them under a faucet

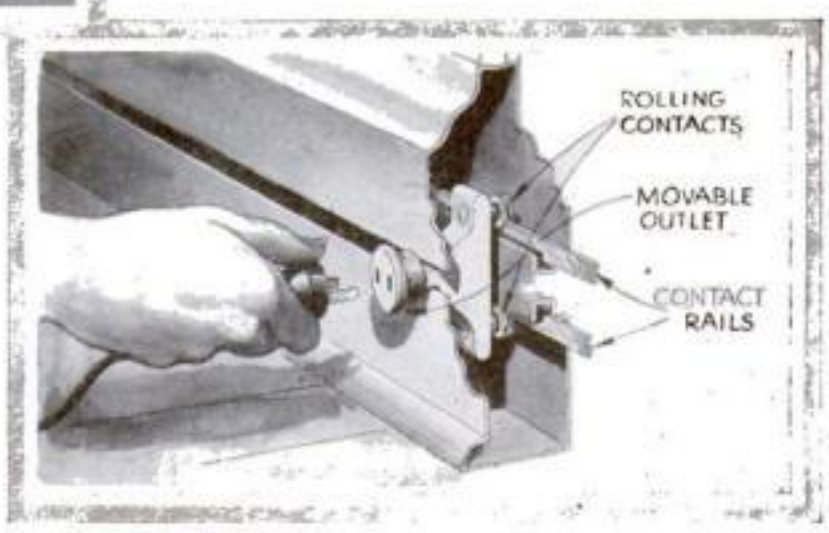
TEA STICK. Tea is made in the cup to suit individual taste with this new device. It also has the advantage of economy. The leaves are removed by taking off the handle

ELECTRIC HEATER FOR HOT WATER BOTTLE. A heating unit that screws into the neck of an ordinary hot water bottle keeps the water at the degree of heat desired



PIE CUTTER AND SERVER. The utensil shown above is handy for cutting pie or cake and lifting it from the pan. It is especially useful for removing a pie that sticks

MOVABLE ELECTRIC OUTLET. Rolling on current-carrying rails within the baseboard, the receptacle shown at the right can be shifted to the most convenient position in the room for any given purpose



SUGAR DISPENSER. An even spoonful of sugar is measured out by this container when it is tipped as shown below. The metal slide and measuring device, which can be seen through the glass, are removed only for cleaning

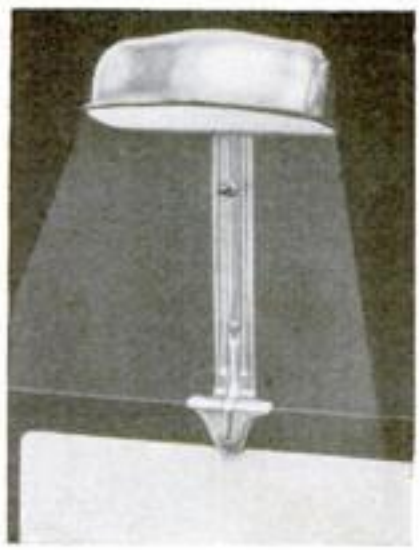
PRAIRIE-SCHOONER LAWN SEAT. Built to resemble the covered wagons of pioneer days, this lawn seat is both comfortable and attractive. In addition to adding a strikingly realistic note, the wheels make it simple to move the seat when the lawn is being sprinkled or mowed

POACHES EGGS IN SQUARES. Square containers in this poaching device shape the eggs to fit neatly on squares of toast. Steam from boiling water placed in the bottom of the pan cooks them

CABINETS IN FOOT OF BED. Space usually wasted at the foot of a bed is put to good use in this practical piece of furniture, providing a dressing table and space for shoes and cosmetics

BUILT-IN FISH BOWL. A new wrinkle for the home is an illuminated fish bowl set flush with the wall. Fresh water circulates continuously through the aquarium and fish are fed by means of a door-like section that swings out of the paneled wall

WINDOW TRAPS BURGLARS. The window shown at the left is equipped as a burglar trap. If a prowler tries to enter, the window snaps down on him while a camera takes his picture and an electric alarm bell is rung



LAMP CLAMPS ON STOVE Light for cooking is supplied by this handy demountable lamp. It clamps on the back of the range

All-Wave Electric

COSTS LESS THAN

Compact, and easy to make, this little giant gives set-builders what they have long wished for

This three-tube loudspeaker all-wave receiver is good-looking. Its cabinet has an ornate crackle finish. Below, rear view, showing general plan of chassis and speaker

By JOHN CARR

GIVING loudspeaker reception and operating on either alternating or direct current, this simplified three-tube, all-wave receiver fills a definite need for the amateur. It is as easy to build as a battery set, requires only a short antenna and no ground, and costs less than thirteen dollars complete, for parts.

Three up-to-date short-wave tubes form the basis of its regenerative-detector circuit and 110-volt A.C.-D.C. power supply. A 6D6 detector and '38 amplifier perform the receiving functions and a '76 serves as the rectifier. Because of the similarity of the tubes, a type '78 can be substituted for the 6D6 without altering the circuit or changing the socket.

Mounted on a roomy 2½-by-6-by-10¾-inch chassis, the parts as shown are arranged to do away with complicated wiring and to allow short leads. On the top face, symmetrically located, are the three tube sockets, the four-prong coil socket, the audio choke, the electrolytic condensers (C8 and C9), and the main tuning condenser (C2). In the two- and one-half-inch space under the chassis are the fixed resistors R4, R5, and R6, the fixed condensers C4, C5, C6, and C7, and the incidental wiring. Holes through the chassis serve to take the grid cap leads and connecting wires.

The combination potentiometer regeneration control (R2) and power switch (Sw.), the resistor R3, the magnetic speaker, and the antenna condenser (C1) are mounted behind the front face of the 6 by 12 by 12 inch cabinet. Although an aluminum cabinet could be used, the crackle finish steel unit shown gives the completed receiver a professional touch and accounts for less than two dollars of the total cost of the parts.

With the exception of the antenna condenser (C1), standard parts are specified throughout. Like the trimmer condenser used in several receivers already described (P. S. M., Oct. '34, p. 63 and Aug. '34, p. 67), this unit consists of a simple postage-stamp 3-35 micromicrofarad (mmf.) balancing condenser supplied with an extension rod and a knob for easy adjustment. Ordinarily, these condensers are mounted under the chassis and must be adjusted with a screw driver. By soldering on the extension shown, however, it can be fastened to the rear of the front panel and controlled by means of the convenient knob.

To save space and to prevent unnecessary overheating, a power cord having a 290-ohm, built-in filament resistance is used in the A.C.-D.C. power supply. This resistor reduces the 110 volts supplied by the regular house lighting line to the eighteen or more volts required for the series-connected heaters of the three 6.3-volt tubes. The combination potentiometer and power switch, also used to save space, is a standard volume control with snap-on switch.

As with all simple all-wave receivers, four-prong plug-in coils designed to operate with a .00014 microfarad (mfd.) tuning condenser are used to change the circuit for the various bands. The coils shown are of commercial manufacture; four units serve to bring in the short-wave bands, and the fifth provides broadcast reception.

If a few simple rules are followed, the wiring of the receiver should cause little difficulty. Simply place the wires as shown in the diagram and photographs. As you progress through the circuit, short cuts, such as using the chassis as a common grounding connection, will suggest themselves. When each connection has been made, pencil a check on the diagram to indicate that that wire has been cared for.

The rectifier socket and combination power cord and filament resistor provide a good starting point. On examining the power cord, you will find that three leads sprout from its end—a white lead, a red lead, and a black lead. The white lead, indicating the resistance, should be connected to one heater terminal of the '76 rectifier, the red lead to one terminal of the switch on the potentiometer, and the black wire to the plate and grid prongs of the rectifier socket. Once these connections are in place the rest of the series heater circuit for the remaining two tubes should be completed.

Particular care should be taken in wiring the four-prong socket for the plug-in coils. The various windings must be connected into the circuit in the manner shown in the diagram;

These close-ups of the antenna condenser show how arm is soldered on

Receiver

$13 TO BUILD

the +F and P terminals serving for the tickler and the G and —F for the grid coil on most standard commercial coils. Check the prong connections inside of each coil form before completing the actual wiring, if they differ from the usual practice, change the connections in the circuit accordingly to keep both windings in their proper relation.

In making the connections to the socket of the 6D6 detector tube, notice that the suppressor and cathode are connected together. Similarly in the wiring of the '76 rectifier socket, the plate and grid terminals are interconnected.

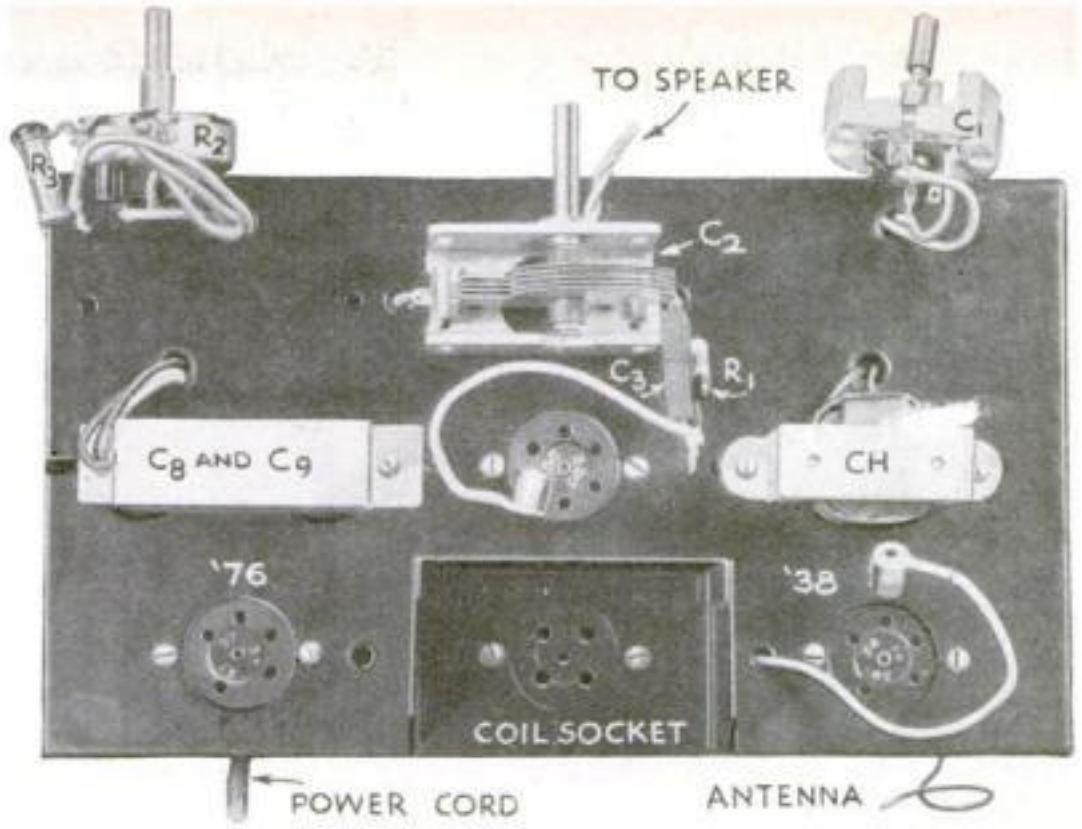
When wiring the tuning condenser (C2), the grid leak and condenser assembly can be soldered directly to the terminal for the stationary plates. In a similar way, the fixed resistance R3 can be mounted directly on one end terminal of the potentiometer R2.

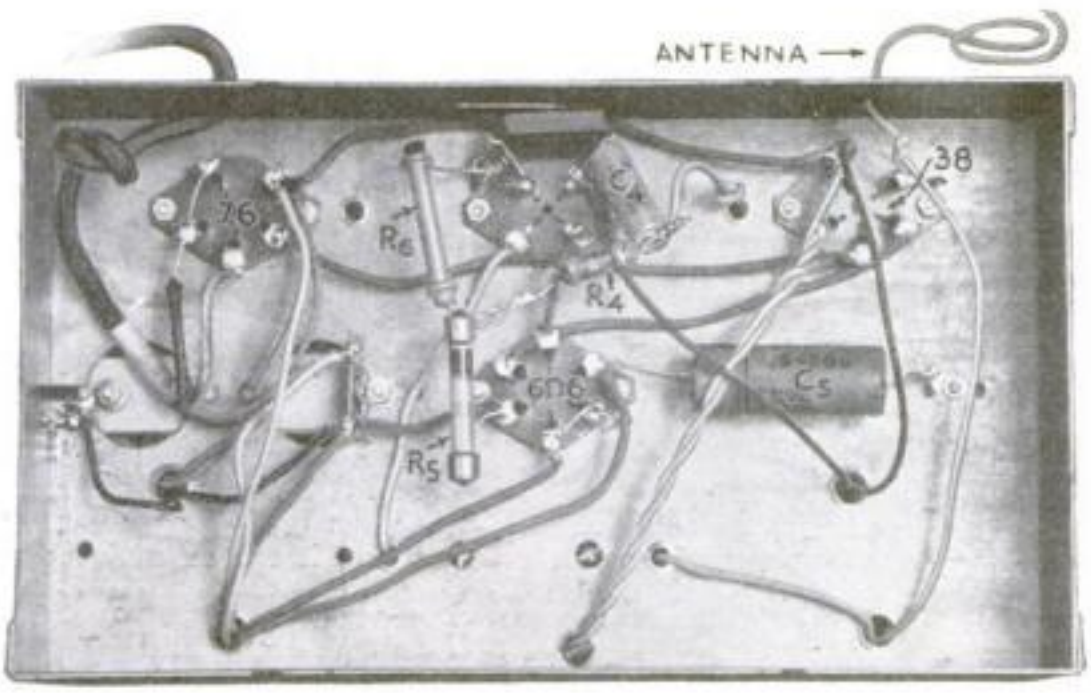
A three-sided metal partition such as shown in the photographs serves to shield the plug-in coil. It is bent from sheet metal and fastened to the top of the chassis with screws or bolts. Make it large enough to allow easy access to the coils.

Another improvement not incorporated in the receiver shown would be to supply a two-circuit jack in the speaker circuit. Simply plugging into the jack then would cut out the speaker and allow phones to be used. The jack could be mounted on the front panel between the speaker and the top of the tuning condenser dial.

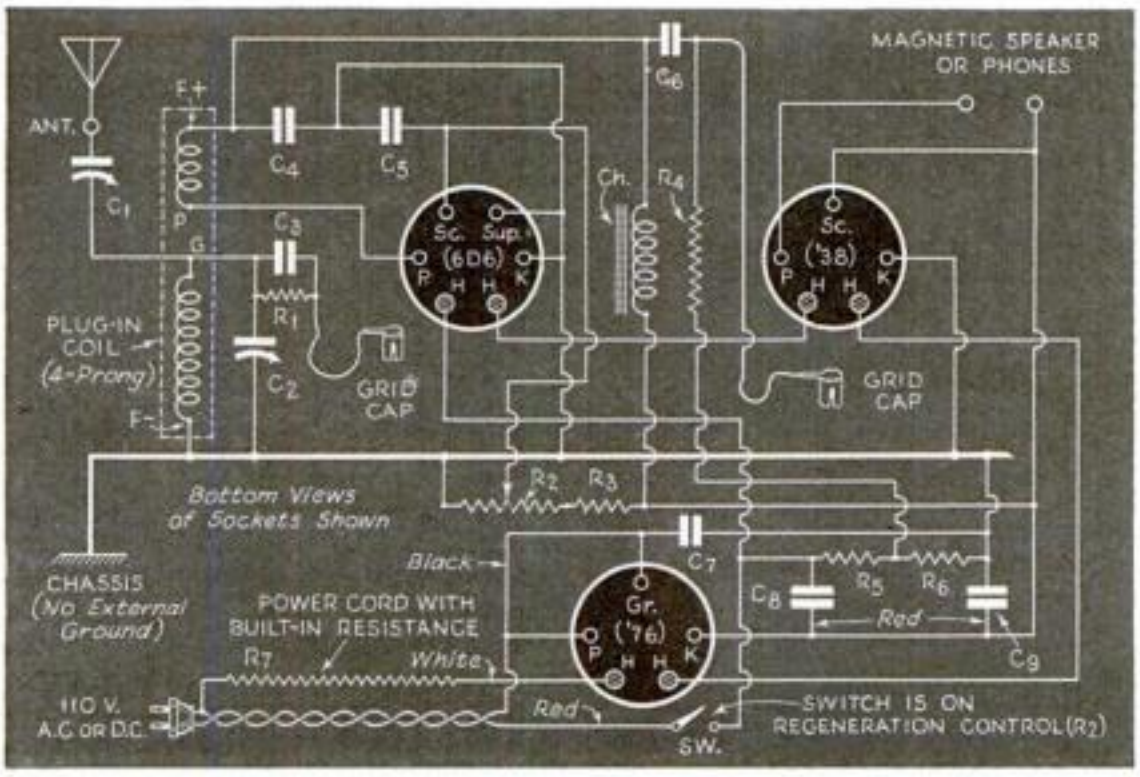
When operating the receiver, use a good outside antenna and no ground. For best results, the antenna should be about seventy-five feet long including the lead-in. Place the set as close as possible to the window that serves as an entrance for the lead-in in order to reduce inside wiring to a minimum.

If, when using the set on direct current, you find that it fails to operate even though the tubes light, reverse the position of the power plug. Remember, there is a positive and minus to direct current power lines and they must be connected into the circuit in their proper relation. On alternating current, any position of the power plug will supply the necessary current for the circuit.





The upper photograph shows the chassis from above, and brings out placing of tube sockets, coil, and the tuning condenser; lower picture illustrates simple wiring



Working from diagram presented above, check each wire as you connect it

What You Need To Build This Receiver

C_1—Antenna trimmer condenser, 3-35 mmf.

C_2—Variable condenser, .00014 mfd.

C_3 and C_4—Fixed condensers, .0001 mfd.

C_5—Fixed condenser, tubular, .5 mfd.

C_6 and C_7—Fixed condensers, tubular, .02 mfd.

C_8 and C_9—Two 8 mfd. electrolytic condensers in single case.

R_1—Grid leak resistance, 5 megohms.

R_2—Potentiometer, with power switch, 50,000 ohms.

R_3—Fixed resistance, 100,000 ohms.

R_4—Fixed resistance, 100,000 ohms.

R_5—Fixed resistance, 3,000 ohms.

R_6—Fixed resistance, 2,000 ohms.

R_7—Filament resistance, built into power cord, 290 ohms.

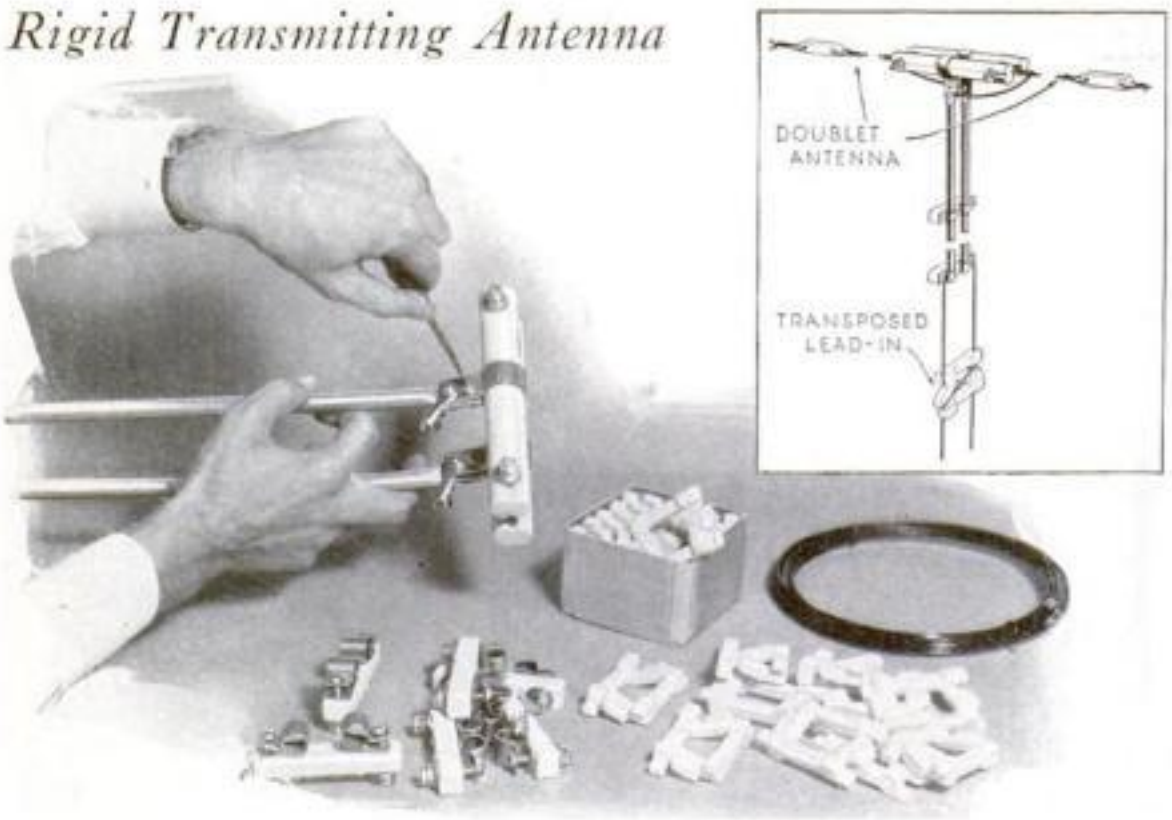
Ch.—Audio choke, 800 henry.

Miscellaneous: Magnetic speaker (5 in.), two five-prong wafer sockets, one six-prong wafer socket, one four-prong wafer socket, two metal grid cap connectors, chassis, cabinet (optional), one set of plug-in coils, dial, knobs, power cord with built-in filament resistance, wire, solder, screws, etc.

Six New Kinks

FOR RADIO ENTHUSIASTS

Rigid Transmitting Antenna



EMPLOYING half-inch-diameter tubing in its lead-in, a new type of doublet transmitting antenna is now available to the short-wave amateur. Its rigid construction makes it possible to match the antenna accurately to the transmission line without the losses generally associated with the flexible wire lead-ins of most doublets. According to its manufacturers, it provides 100 percent more radiation than the common doublet for the same power and provides matched impedances regardless of the transmission line length. Although primarily a transmitting antenna, it can be used for receiving.

Slide-Rule Disk Finds Short-Wave Stations

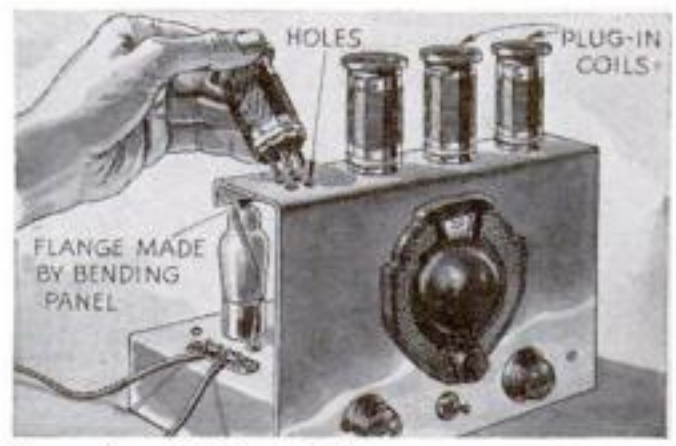
DESIGNED along the lines of the familiar circular slide rule, a new commercial short-wave log and station finder serves as a convenient guide to the principal transmitters of the world. A single setting of its rotating arm gives the day and the hour of broadcasts, the frequency in kilocycles, the location by city as well as nation, and the call letters for any one of ninety short-wave stations. It provides a simple way of tracking down both local and foreign broadcasts and eliminates unnecessary dial twisting.

A Three-Purpose Tool

A THIRD hand for the amateur set builder is now available in the form of a combination clamp, retriever, and test prod. Anyone who has made receiver meter tests knows how hard it is to hold the two test prods in place and at the same time turn the controls. With the prod shown, rigid spring jaws serve to hold it in place. If a nut or screw is accidentally dropped into the depths of a chassis, the jaws of the prod also can be used as a retriever; when you are making a soldered joint, they can serve as a clamp to hold the wire in place.

How to Make a Handy Rack for Spare Coils

BY FORMING a narrow flange or shelf along the top of the panel on your next home-built receiver, you can provide a convenient rack for the plug-in coils. Holes drilled slightly larger than the prongs on each coil and placed in the same relation will serve to hold the units in place. Also, if desired, a label can be mounted in front of each coil to indicate the wave band covered.



One motion of the hand will insert extra coils in rack

Four-in-one Screw Driver for Myriad Uses

AT LEAST three sizes of screw drivers are needed in the construction of even the simplest receiver. The handy tool shown supplies four. Ingeniously nested one within the other, they take up less room than an ordinary screw driver. Contained in a single holder, they are close at hand when needed. The tiniest unit is particularly valuable for adjusting the microscopic set screws on most dials.

Fingers select tiniest of nested screw drivers

Self-Tapping Screws

BY BORROWING a production kink from the set manufacturer, the amateur can save himself a great deal of time and trouble. Few commercial chassis are now assembled with machine screws and nuts. Instead, self-tapping machine screws are used and the same idea can be applied to the home-build receiver. Requiring no nuts, they are simply driven like a wood screw into holes made in the metal. Their special threads cut into the metal like a tap.

The gorgeous flower shown at the right is a dahlia-petaled zinnia. It was created by hybridization and selection. The author, below, is "budding" a plant

You, Too, Can Create Beautiful New Flowers

These fantastically beautiful scarlet-gleam nasturtiums, produced by a scientific gardener, the author, have two rows of petals

By John C. Bodger

•

WILTING in the hot sun that beat down on the dried-up patio of a home in Mexico City, a handful of what once were thriving nasturtiums struggled for life. They were, I had been told, double nasturtiums, flowers so rare that only two such plants were to be found in the United States.

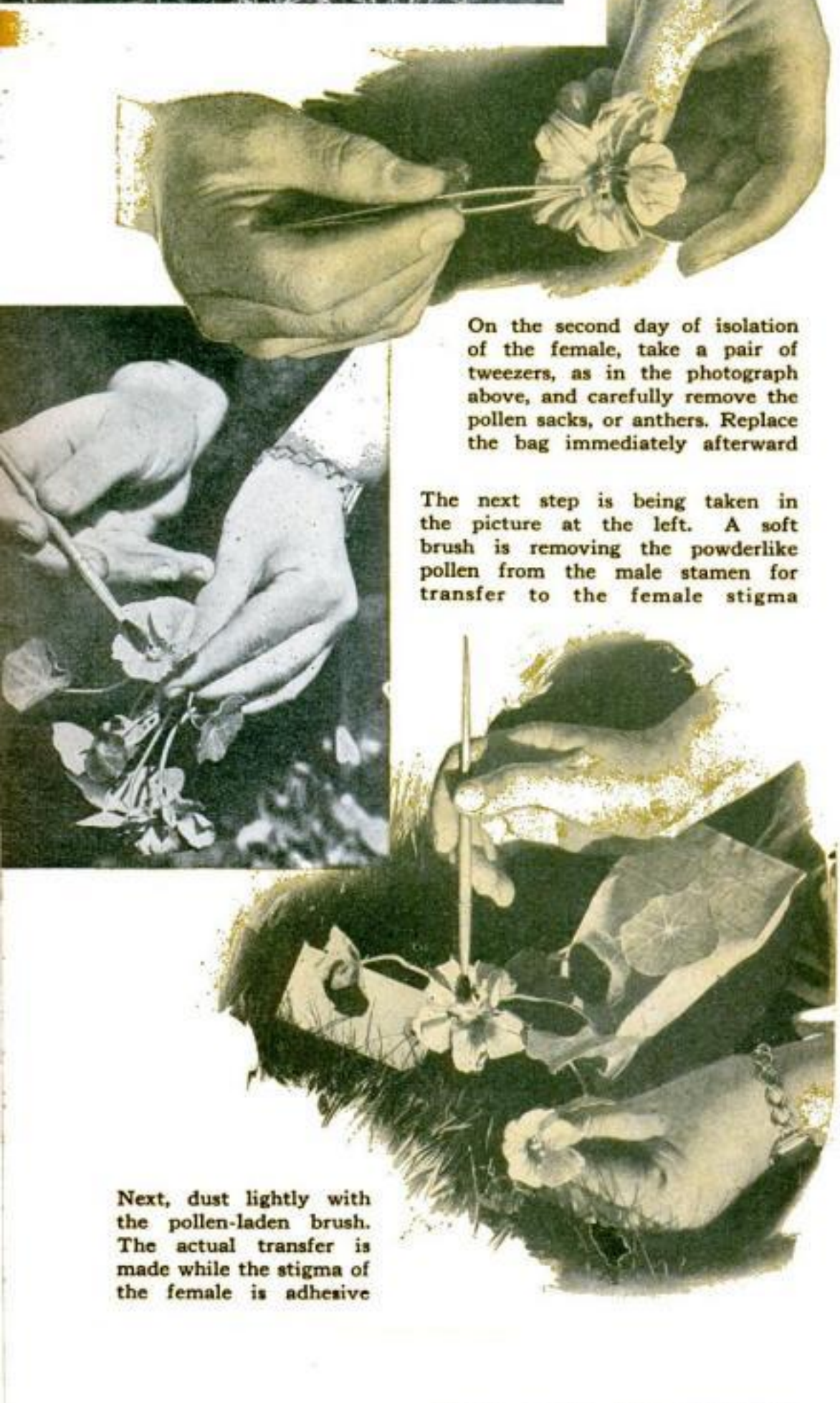
Like a prospector on the trail of gold or rare jewels, I searched the neighborhood. At last I returned to my home in El Monte, Calif., sure I had the only double golden-yellow nasturtiums in the world. Earlier, I had acquired the only two known to exist in my own country.

I planted the seed in fertile soil. During the first two years not only beautiful double golden nasturtiums, each flower containing two rows of petals, sprang up, but also several sports, or variations, including some scarlet flowers.

Here I had the key to a new species—sought by every enthusiastic horticulturist. By selecting sturdy plants bearing double golden flowers I made that strain permanent. Lovely indeed were the offsprings of those once-shriveled plants, which, but for a chance discovery, soon would have been lost to the world. And again, by crossing and selecting plants bearing scarlet flowers, I soon evolved the double scarlet nasturtium, and from it I bred other colors, new beauties.

Chance discoveries such as this, and the efforts of amateur gardeners, give the world many of its strange and gorgeous flowers. Many species are comparatively unknown, born to blossom for fanciers only.

In hybridizing, cover both the male and female flowers with bags, in method illustrated at the left. This prevents pollination by chance. Label each bag



On the second day of isolation of the female, take a pair of tweezers, as in the photograph above, and carefully remove the pollen sacks, or anthers. Replace the bag immediately afterward

The next step is being taken in the picture at the left. A soft brush is removing the powderlike pollen from the male stamen for transfer to the female stigma

Next, dust lightly with the pollen-laden brush. The actual transfer is made while the stigma of the female is adhesive

Whether new or old, rare or common, sturdy or weak, all flowers require care if you wish to obtain from them the utmost in beauty. They suffer diseases exactly as do humans; they die from thirst and hunger, wilt in cold weather—but lift their heads proudly to blossom and bloom in lovely colors when given freedom in soil and the kind treatment they need.

The amateur fancier can do more than merely to raise orthodox strains. He can convert his greenhouse or garden into a scientific laboratory and produce his own new species with relatively little difficulty, provided he observes a few simple rules and crosses flowers of the same species.

Never try to cross a rose and a zinnia; it simply cannot be done. You can, however, hybridize any common flowers grown from seed. The nasturtium, snapdragon, larkspur, or sweet pea can be crossed with comparative ease. Asters and zinnias will prove more difficult.

Suppose you decide to cross a large flowering single red with a smaller double yellow. Here are the steps to follow:

Choose the parent plants when they first begin to flower. Mark each carefully with a tag or stake. On each of these plants, select the particular flowers which you want to serve as parents. Cover them with small manila sacks clipped shut at the mouths, to keep out stray pollen with which the flowers might be impregnated by wind or bees.

Bags and clips for isolation, scissors to trim away superfluous petals, tweezers to remove pollen parts, and a brush for transferring pollen from the male stamen to the female stigma are all the tools you need.

Having encased the female flowers in bags, isolate the male parent similarly, to be sure of a pure cross. Select a slightly older male flower, to have it ready for pollination when the stigma has become receptive. To determine the receptivity, remove the bags every day or so and examine the flowers. When the stigma becomes sticky and gummy, it is ready to hold the pollen. Care must be taken to avoid chance crossing with some unwanted strain, because bees sometimes carry pollen several miles, and the wind carries it as far as two city blocks.

On the second day after bagging the female, remove the pollen anthers, or sacks, before they open out, by nipping with tweezers. Replace the bag and leave it in place until the stigma becomes receptive. When examination reveals that the stigma has become sticky, and that the pollen is ripe on the male, take all the pollen you can crowd on the bristles of a small brush and transfer it to the female. The pol-

Right, erect four protective walls of cheesecloth or a coarse muslin. Plants chosen to become parents of new floral fantasies must be shielded as this one is

len, which suggests a small powder puff, should be dusted lightly on the stigma. This done, bag up the flower again and let the seed set from two or three weeks, to ripen.

Successful crossing is not a short process, to be completed in a few days. Nature must be permitted to take her time. Plant the hybrid seed the following year; then observe the results of your cross. If you have crossed a large red flower with a small double yellow, you may look for a large double red. However, do not be disappointed if the results are unexpected; plant the resulting seed.

Often at this stage in hybridization, gardeners decide that the cross has not taken. The apparent failure may result because some desired characteristic, such as size or color, is recessive, or covered by some dominant characteristic. For instance, if you cross a tall and a dwarf, you may get more small plants the first year; the second year, large and small may be equal in number, and in the third season, if you have continued to select seeds from the tallest specimens for planting, tall, vigorous plants should predominate.

If you happen to get a double red in the second generation when crossing, take immediate steps to prevent chance crossing, particularly if you have other plants of the same family near-by.

The plant may be easily and inexpensively isolated. Drive four laths into the ground to form a square. Wrap a length of cheesecloth or coarse muslin around the stakes, pull it down to the ground, and draw it nearly shut at the top. By using coarse-grained cloth, you permit the air to reach the plant, yet prevent the entry of insects and pollen. It is not necessary to conduct these experiments in a greenhouse; if rain threatens outdoors, cover the plants with lath and burlap to keep the water from beating them down.

By selecting carefully only those plants which show the colors, sturdiness, and other characteristics you desire to develop, you should have, after the third generation, a new species in which you can take delight. It will be a creation of your own imagination and gardening skill.

Zinnias are among the most satisfactory flowers for the average garden, because they

A thin layer of gravel is placed in box. Preparing to plant the seed

Above is shown a new zinnia, a creation that won an award of merit. It is a shaggy-petaled beauty in three colors

To water seeds lightly use a syringe like that in use at right. Left, a pipelike sower

At left, below, appears the grand champion orange cosmos

are practically fool-proof. What the hybridizer has accomplished with them, and with others, is well shown in the eighteen varieties, of eighteen colors, now on the market. All came from a single crimson dahlia-type zinnia which I found in a field of double giants at El Monte, eighteen years ago.

This flower had the shape of a show dahlia, with upstanding dahlialike petals. After discovering the specimen, I followed the plan I have described, for hybridizing. I planted the seeds from the crimson beauty, and carefully isolated them. The first year they threw flowers of four different colors. These four threw still more colors the second year. I found they hybridized easily, and as time went on, by crossing the desired shades, I obtained true and permanent colors. Today the great-grandchildren of that sport have the largest flowers of all zinnias marketed. From that one plant, gardeners throughout the world now enjoy a range of colors once thought impossible,—the offspring of the native Mexican plant called "eyesore of the hillsides"—a single scraggly dull-orange or reddish-magenta flower once considered unworthy of purposeful reproduction.

Your garden, whether atop an apartment roof or covering a spacious yard, will be what you make it. Plants respond to

The wonders of creative botany can be seen above in this magnificent aster, one of the largest known. It is called the Super Giant

In an amateur's garden grew this lovely armful of shasta daisies and carnations. Who could help being proud of such a display? Wouldn't you?

kindness in the form of food and moisture. Their growth responds directly to the nature of their surroundings. Like children, they should be given the right start in life.

Although most perennials and annuals do not require an indoor start from seed, you may desire to plant some of the smaller seeds—such as petunias, asters, and snapdragons—in a greenhouse, or on the back porch, before the outdoor season is favorable. These simple suggestions, which are universally followed by professional growers, will help you.

First, provide yourself with a shallow box. It should measure about sixteen by twenty inches and be four inches deep, with holes in the bottom for drainage. Put in a layer of coarse gravel, not more than three quarters of an inch deep.

Meanwhile, prepare the soil. It should be a sandy loam, consisting of dirt, sand, and leaf mold, rotted leaves, or commercial peat, mixed in equal parts. The proportions may vary slightly, according to the heaviness of the soil. Moisten the soil, as you mix it with a trowel or with your hands, but do not soak it. Fill the box so that the soil will come one half inch from the top, after it has been tamped with a flat board. Make sure the corners are level, so that water will not collect in little pools to soak parts of the soil when you use the sprinkling syringe.

Scatter the seeds over the tamped surface, using a sower resembling a tobacco pipe. They may be broadcast or dropped in rows one inch apart. I prefer dropping them, because the seeds will thrive better when not sown too thickly. When you are planting very fine seeds, such as primrose or lobelia, it is not necessary to cover them with soil. Merely "water them in," using a sprinkling can or syringe.

Heavier seeds, such as zinnia or aster, should be covered in one eighth to one quarter of an inch of a mixture of sand and light soil or peat. Water them lightly after this protective covering has been spread.

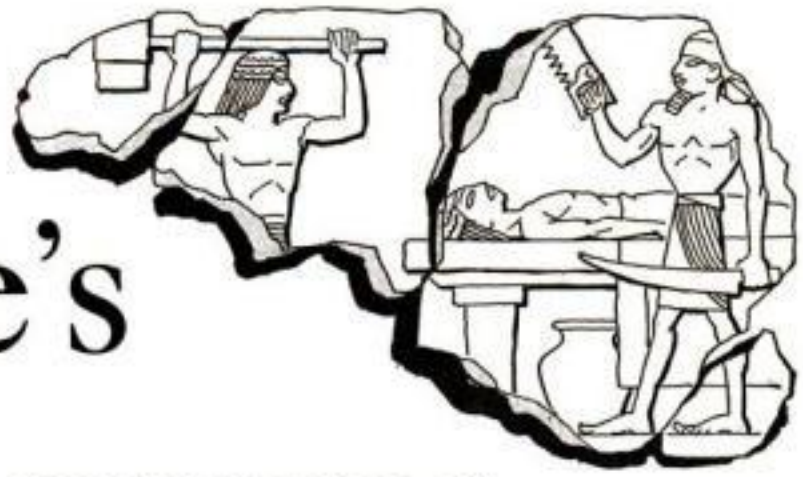
In both cases, cover the flat box with a burlap sack, and support it in the center with a light board, until the seeds begin to sprout. The time will vary with the seed; from three to six days are needed for asters and zinnias, and three weeks for delphinium. An occasional examination will reveal when the proper time for removing the cover arrives. Meantime, keep the soil moist but not soggy.

Young plants naturally will seek light and become leggy. For that reason, leave them in the sunshine after they start sprouting; on very hot days provide a little diffused shade with a sheet or sacks high above the flat box. It is important to observe them daily after the first pair of leaves arrive; when the second pair show, the time has come for transplanting to another box. Here the plants should be spaced from an inch to one and one half inches apart in all directions. In about four weeks, they will attain sufficient strength and stature to be set out in the garden.

Preparation of the garden soil is important. It should be loosened, cultivated, and leveled; moistened, but not made soggy. When you are setting the young plants, scoop out the earth with a trowel or with your hands; place the roots in the earth in their natural position. After returning the soil to its place, tamp it down lightly but firmly to make sure no pockets of air remain. You may then water each plant individually, or sprinkle all generally. They have become reasonably husky at this stage of their growth, but to give all an equal chance to attain satisfactory growth, the soil, if poor, should be enriched by barnyard manure or commercial fertilizer. This may be applied in *(Continued on page 108)*

Richly hued, full-bodied roses like these can be grown by anyone who has a knowledge of care of the soil, pruning, and budding. After flowering, bushes must be pruned back severely to the length shown

Question: How were patients of ancient times anaesthetized? E. H., Dover, N. J.

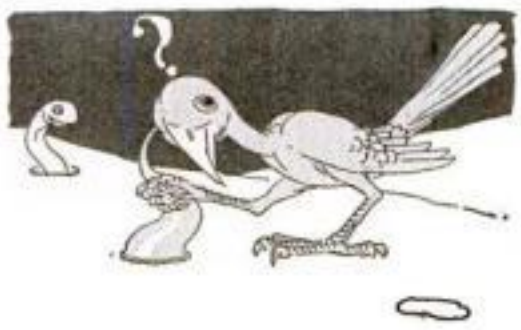


Here's *the* Answer

A.—ALCOHOL was used a great deal, and also the juices from certain plants, such as opium. Egyptian surgeons, it is said, developed a way of hitting the patient on the head in just the right place to produce harmless unconsciousness.

First Candle Power

R. W., LOUISVILLE, KY. Because of early methods, the term candle power is used as the unit of light. Early scientists, desiring a means of comparing light intensities devised the standard candle made of special wax and to a specified size. Although the comparison now is made electrically, the old term still is in almost universal use.



The Robin and the Worm

P. H. F., RICHMOND, VA. According to a recent report by naturalists, robins locate their dinners by sound, hearing or perhaps feeling the vibrations and noises made by the worms as they travel through the ground. On the other hand, since naturalists also believe that the worm can hear the footsteps of the birds, it must resolve into a game of hide and seek. The bird, of course, is often the loser.

Oxygen Is Brain Food

T. W. A., LOS ANGELES, CALIF. The human brain is extremely sensitive to the least lack of oxygen. In a recent test, a university professor, placed in a room supplied with air having only one half its usual amount of oxygen, insisted heatedly that four times four are twelve. His answer, however, did not indicate a lack of knowledge of elementary mathematics, but of a vital element.

Keeping Windshields Clear

K. D., NEW HAVEN, CONN. A solution for preventing rain and other moisture from collecting on the windshield of your car can be made by heating one and one half gallons of water to boiling and adding one ounce of sodium oleate and one ounce of glycerin. Boil the mixture for about five minutes and then, after immersing a suitable cloth in the liquid, boil it for ten minutes more. To use the prepared cloth after it has been removed and allowed to dry, simply moisten the glass and run the cloth over the surface once.

Deepest Oil Well

W. G. S., CLEVELAND, O. Located in California, the deepest oil well in the world, extends some 11,000 feet below the surface.

Frost-Bitten Plants

Q.—HOW DOES frost kill a plant or flower?—P. T. F., Kingston, Ontario, Can.

A.—EACH tiny cell in the structure of a plant contains a small amount of water. When this freezes, it expands, ruptures the cells, and kills the plant.

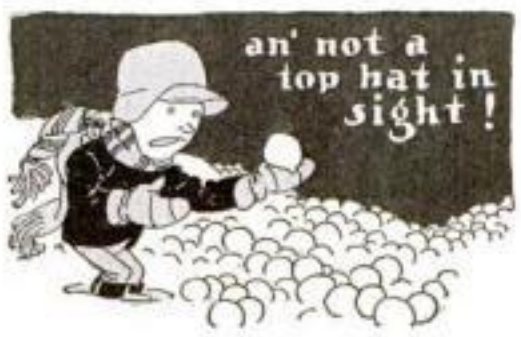
Quite a Poison

V. B. G., PITTSBURGH, PA. A toxin produced by the germ which causes botulism, a variety of food poisoning, is the strongest poison known One spoonful of it would be enough to kill all the inhabitants of the earth.

White Cats Deaf?

Q.—IS THERE any truth in the statement that most white cats are deaf?—J. L. A., Buffalo, N. Y.

A.—ALTHOUGH deafness and albinism sometimes go together in animals, poor eyesight is a more prevalent common quality. The lack of pigment in the eyes allows too much light to reach the retina.



Snowing Snowballs?

Q.—WHY, after a recent snow storm were northern New York farms covered with big snowballs?—J. K. B., Plattsburg, N. Y.

A.—A WHIRLING wind undoubtedly rolled bits of snow along the snow-covered ground as a child does when making large snowballs. The top snow being moist, adhered, and the balls increased in size.

A Hard One on Water

Q.—WHICH is the most common type of water, hard water or soft water?—I. F., Kansas City, Mo.

A.—ACCORDING to a recent survey made of water supplies in 670 cities, four fifths of the homes are supplied with relatively soft water.

It's Gold To Some Folks

Q.—HAS USED motion picture film any particular use?—S. H., Watertown, N. Y.

A.—IT IS decidedly valuable. In one large plant in Hollywood, $17,000 worth of silver is reclaimed from every 350,000 feet of old sound track film.

Average American Man

J. W. R., TUSCON, ARIZ. Although males from your section of the country usually are tall, the average American man measures approximately five feet eight inches in height.

A Natural Remedy

Q.—WHEN was petroleum first discovered and used?—O. R. D., Atlanta, Ga.

A.—STRANGELY enough, petroleum first appeared as a medicine. In 1849, a Pittsburgh druggist found some oil in a nearby brine well. Deciding it was a fine remedy for a variety of ills, he bottled it and offered it for sale at fifty cents a half pint. At Titusville, Pa., ten years later, the first oil well was constructed, and the great boom began.

Shocking News

D. F. V., Jr., ST. LOUIS, MO. Large electric eels are capable of giving shocks up to 200 volts. The electricity, thought to be generated by muscles in the eel's body, sometimes can even penetrate thick rubber gloves.

Moon's Mountains

H. G. F., SEATTLE, WASH. The largest mountains on the moon are thought to be 25,000 feet high; its craters are 24,000 feet deep.

High Flyers

F. T. C., DENVER, COLO. Although no accurate record of the altitudes reached by birds has been kept, climbers on Mt. Everest have reported seeing curlews at 20,000 feet.

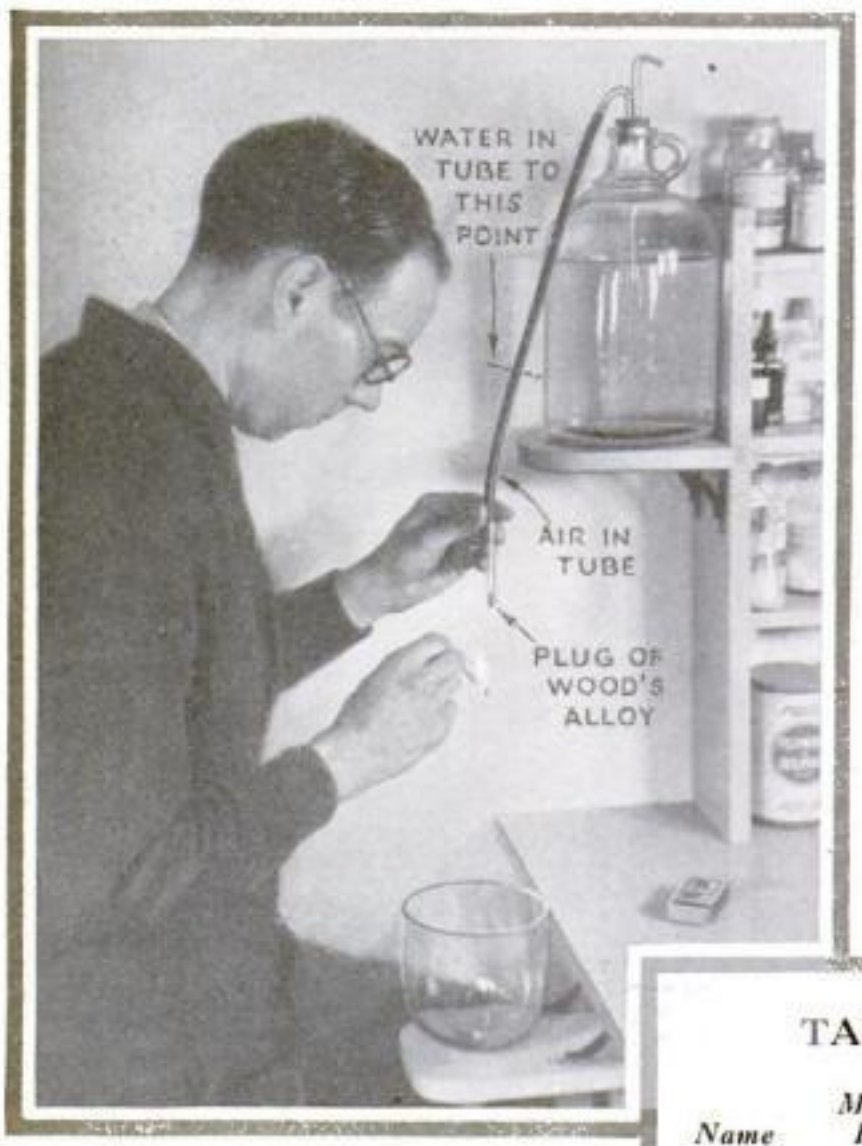
Both Have to Eat

Q.—IS IT true that only the female web-spinning spider builds the webs?—R. W. M., Boston, Mass.

A.—NO. BOTH the males and females build webs, but because the male often lives with the female, a great *(Continued on page 102)*

Experiments with Alloys FOR THE HOME CHEMIST

By RAYMOND B. WAILES



This simple equipment will demonstrate how automatic water sprinklers operate in extinguishing fires. Heat from the flame of a match melts the plug of Wood's alloy, releasing a stream of water from the siphon tube

SEARCH through the list of true metals and you will find neither brass nor bronze. To the uninitiated, this may seem like an oversight, but it is not. They are neither elements nor basic metals, but two of a large and interesting group of substances known as alloys.

Like a solution of sugar in coffee or sand in water, alloys are not chemical combinations, but mechanical mixtures. Solder is an excellent example. Although tin and lead are mixed to give what looks like an entirely new metal, it is merely a homogeneous mass containing both of the metals in their original unchanged form.

One of the most curious and important properties of alloys is their low melting point. It would be reasonable to suppose, for instance, that a mixture of bismuth, tin, and lead, with melting points of 271, 232, and 327 degrees Centigrade respectively, would have a combined melting point somewhere between 232 and 327 degrees. Make up such a mixture, however, by adding two parts by weight of bismuth and one part of tin to one part of molten lead, and you will be surprised to find that the product becomes a liquid at ninety-three degrees Centigrade, seven degrees below the boiling point of water and 139 degrees below the melting point of tin. Such an alloy is known as Rose's metal.

Wood's alloy, consisting of bismuth, tin, cadmium, and lead, melts at an even lower temperature. To make this mixture, melt two parts of lead, then add one part of tin, and finally four parts of bismuth and one part of cadmium. During the melting process, heat the metals carefully, since both cadmium and bismuth tend to take fire at extremely low temperatures.

By making use of the low melting point of Wood's alloy, the home experimenter can prepare a mystifying trick spoon that will fool even the most suspicious of his friends. Saw an inexpensive teaspoon in half and then, using the Wood's alloy you have made, solder the two halves together again. This can be done by applying soldering fluid (zinc chloride will do) to the cleaned edges, heating the two ends to remove the excess water, applying the molten Wood's mixture, and clamping the sections in place.

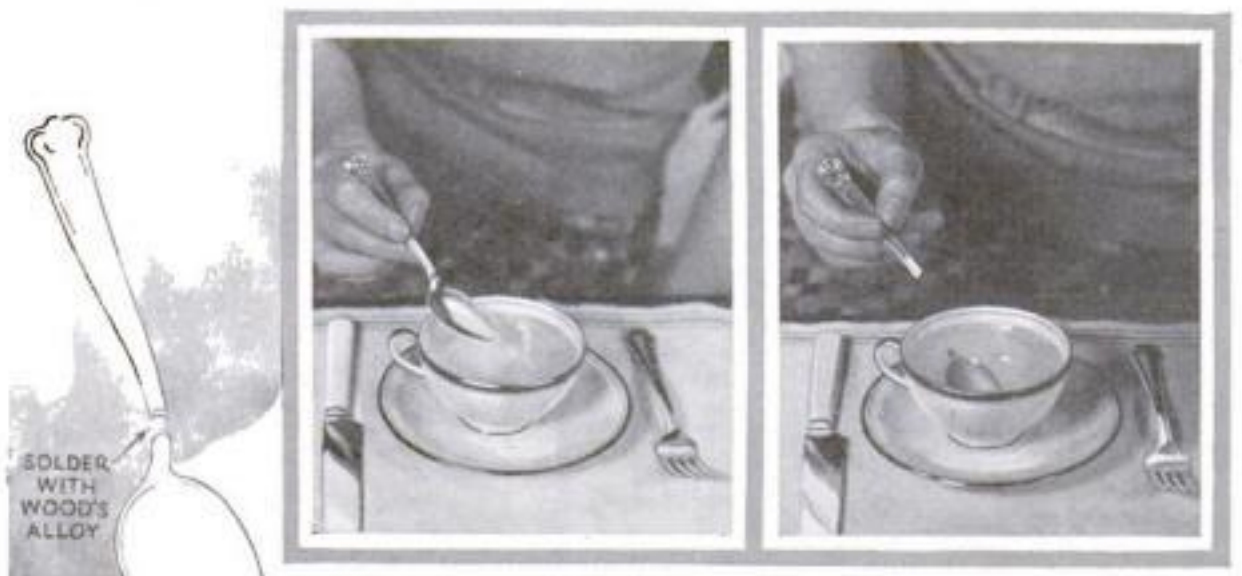
Acting as a solder, the alloy will sweat the two pieces together. At ordinary temperatures, the spoon will remain intact, but as soon as it is dipped into a hot liquid, the alloy will melt and the two sections will part company. Serve the trick spoon with some coffee when a friend is visiting and watch his embarrassment and surprise when it "breaks."

How the low melting points of alloys make them valuable is best illustrated by the automatic sprinkler system used in modern office and factory buildings. In such a safety arrangement, water pipes, zigzagging across the ceiling, are fitted with fused sprinkler heads. The fuse in each case is a link of low-melting alloy which holds a spring valve in the closed position. Any fairly high temperature, such as that caused by a fire, melts the alloy and releases the water supplied under

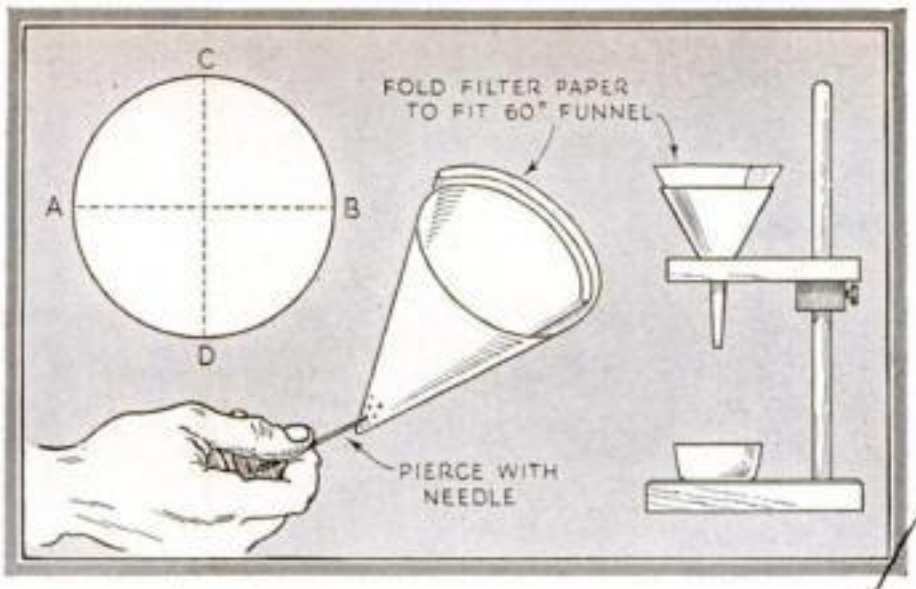
TABLE of ALLOYS

Name	*Melting Point*	*Parts by Weight of* Bi	Sn	Cd	Pb	Hg
Lipowitz's	70°C. 158°F.	15	4	3	8	0
Wood's	66°C. 151°F.	4	1	1	2	0
Rose's	93°C. 200°F.	2	1	0	1	0
D'Arcet's	80°C. 176°F.	8	3	0	5	0
Solder	275°C. 527°F.	0	33	0	67	0
Fusible spoons		45	17	0	30	5-10

Bi-Bismuth, Sn-Tin, Cd-Cadmium, Pb-Lead, Hg-Mercury



You can play an amusing trick on your friends by making use of the low melting point of Wood's alloy. A teaspoon, sawed in half and soldered together with the alloy, breaks when dipped into a hot liquid



Mercury dulled by impurities can be cleaned by filtering through filter paper in which small holes have been punched with a needle

The Mysterious Properties of the Large and Interesting Group of Substances Known As Alloys Offer Many Opportunities for Experiment

pressure through pipes from the mains.

Just how this mechanism operates can be illustrated in a slightly simplified form right in your home laboratory. Select a short length of glass tubing and plug one end by dipping it into molten Wood's or Rose's alloy. The sealing plug, when it cools, should be about one quarter inch long. Then connect this glass nozzle to the rubber outlet tube on your laboratory siphon bottle, taking care to see that the water completely fills the tube but does not touch the fusible plug.

Finally, with your sprinkler ready, kindle a small fire of match sticks or paper and hold the plugged nozzle above the flames. Even the heat from a single match will melt the alloy and allow the water to flow from the siphon tube.

Low-melting alloys also have hundreds of other uses. In the early days of radio they were used for mounting the sensitive crystals that formed the heart of every receiver. Today, they form the basis of fusible plugs to protect modern steam boilers from a combination of excessive temperature and pressure.

Besides their peculiar low melting points, alloys also exhibit an equally curious color effect. The home chemist mixing seven parts of copper and three parts of tin could well expect that the product would be copper-colored. Yet, the mixture is unmistakably white. Similarly, a five-cent piece contains three times as much copper as nickel, yet it is far from being the color of copper.

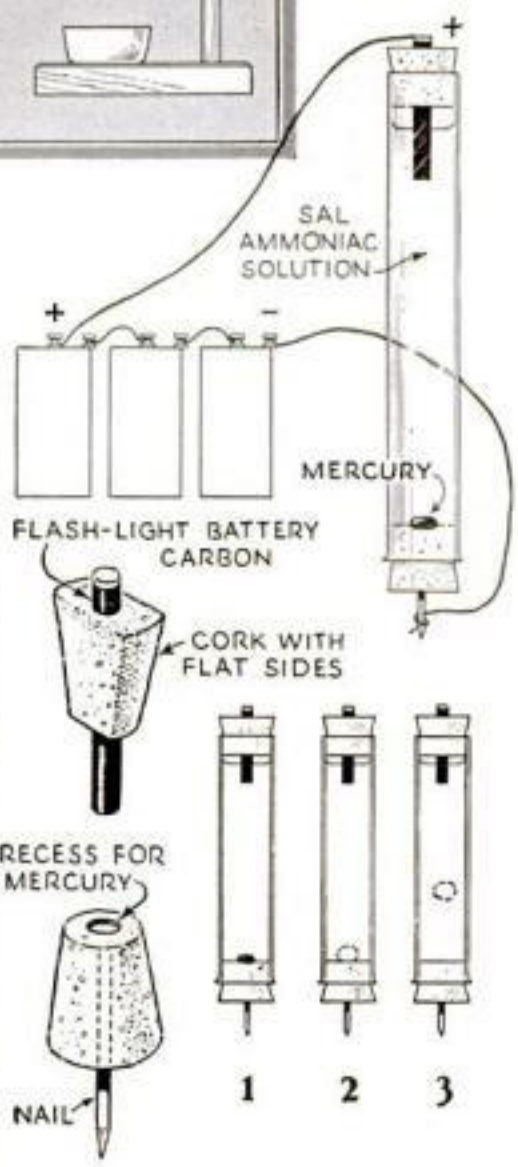


Photo and drawing show how you can make ammonium amalgam. An electric current is passed through a solution of ammonium chloride. A drop of mercury amalgamates with ammonium set free by the current

Another curious property of alloys is their reaction to cold and heat. Like most metals, some alloys contract when they cool and solidify; others, however, expand. It is because printer's type metal has this latter characteristic that the printing on this page is sharp and easy to read. Poured into a mold, such as a matrix in a linotype machine, it expands to fill every nook and corner and give a sharp impression.

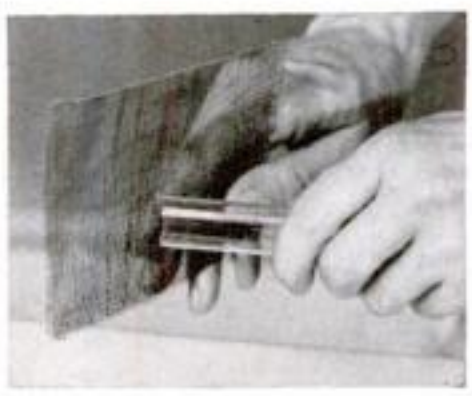
Heat is not always necessary to the formation of an alloy. Brass, an alloy of copper and zinc, can be electroplated on other metals. Gold and lead can be made to alloy simply by placing them under pressure. And, being a liquid at ordinary temperatures, mercury can be alloyed with most metals merely by bringing them into contact.

When mercury forms an alloy, the product, called an amalgam, usually is soft and pasty. Home chemists who have been so unwise as to experiment with mercury while wearing a gold ring are familiar with the silvery alloy formed when mercury amalgamates with gold. Incidentally, if the ring is solid and contains no stones, the film of amalgam can be removed by gently heating the metal for a moment.

Because it combines with other metals readily, mercury that has been used often loses its metallic luster. This dullness caused by impurities can be removed by filtering the mercury through ordinary filter paper which has been folded in the usual way and then punched with a needle. The dross, consisting of bits of metallic oxide and detrital substances, will be left on the filter paper.

Besides combining with metals, mercury also can be made to form an amalgam with a curious set of elements called the ammonium group. The experiment, an amusing one, is performed by passing an electric current through a solution of ammonium chloride (sal ammoniac).

In making up the necessary apparatus, a short piece of half-inch-diameter tubing plugged at one end with rubber stopper forms the container. A nail, pushed through the stopper with its head countersunk into the rubber, serves as one electrode, while a carbon rod taken from a flash-light cell and inserted into the upper open end of the tube forms the other. A drop of mercury should be placed in the depression occupied by the nail head, the tube filled with strong ammonium chloride solution, and the carbon rod fastened over the tube in *(Continued on page 103)*



TO SMOOTH GLASS TUBES

Sharp edges formed at the ends of glass tubes when they are broken, can be removed as shown in the photograph. Short downward strokes with a piece of stiff wire screen take away the sharp points

Illustration by FRANK HUBBARD

As Gus watched, the line of cars stopped suddenly. Just at the foot of the hill, a sedan was holding up the heavy traffic

Check Up on Your Clutch

By MARTIN BUNN

WAITING on the curb for the light, Gus Wilson watched the long line of cars start their climb up the steep Center Street hill. It was the usual Sunday afternoon traffic jam.

Suddenly, the line stopped. A sedan, just at the foot of the hill, was having trouble. Horns tooted, gears growled, and men shouted. In spite of the plume of smoke that puffed rhythmically from its exhaust pipe, the car could not budge. At last, with a clanking and scraping of bumpers, the car behind pushed it around the corner and out of the way.

Gus shouldered his way through the small crowd that had gathered around the stalled car and spoke to the driver.

"My name's Gus Wilson," he said. "I run a garage and I thought maybe I could give you a hand. What's your trouble?"

"Blamed if I know," the man replied, fiddling nervously with the gearshift lever. "Everything was all right until I started up that hill. When the light changed, I put her in low, let out the clutch, and stepped on the gas. She went ahead for a few feet, then the motor started racing and she stopped."

"Mind if I try?" asked Gus. "You're on level ground now, and she may act better."

Gus edged into the driver's seat and stepped on the gas. "Sounds swell!" he commented, as the motor raced. "The gear shift seems to work all right too."

The veteran mechanic shifted into low and cautiously let out the clutch pedal. At first, nothing happened, but as he fed the motor more and more gas, the car moved unsteadily ahead like a snail.

"I'm sorry, mister," Gus said, shaking his head, "but your clutch is shot. It's slipping so badly it won't drive the wheels."

"The clutch!" echoed the man. "Gosh, now I *am* in a pickle! Something like this would have to happen, when I'm sixty miles from home!"

Gus pulled his watch from his pocket. "It's just two o'clock now. Why not let me coax the car over to the Model Garage. If we work fast, and have any luck, we ought to be able to fix the car up by five."

Once Gus had donned his overalls and cap, he wasted no time. In less than three quarters of an hour he dropped the transmission, loosened the clutch cover, and had the main clutch assembly out on his work bench.

"So that's what a clutch looks like!" exclaimed the car owner. "Sort of a combination of springs and plates, isn't it?"

"That's right, and it's those springs and plates that hook up your motor with the main drive shaft when you let out the pedal. This particular clutch is what is called a single dry-plate type. See this?"

Gus held up a thin metal disk about ten inches in diameter; on each side it had a flat ring of hard, fabriclike material. "That's the clutch disk. It's fastened to the shaft that drives your transmission, and rides between the inside of the flywheel and a heavy plate attached to these springs. When your clutch pedal is out, the springs force the pressure plate toward the flywheel, clamping the clutch disk in between. Naturally, it binds against the flywheel and turns every time the flywheel is turned by the motor.

"Now," continued Gus, stopping for a breath, "when you push your clutch pedal down, the springs are compressed, the pressure plate is moved away from the flywheel, and the clutch disk is free."

"But what's this stuff for?" interrupted the car owner, pointing to the ring of fabric on one side of the disk. "Looks like brake lining."

"And it *is* something like brake lining," agreed Gus. "That's the friction surface that makes contact with the flywheel and the pressure plate when the clutch pedal is all the way out. And, incidentally, it's the one thing that wears in a clutch and causes trouble.

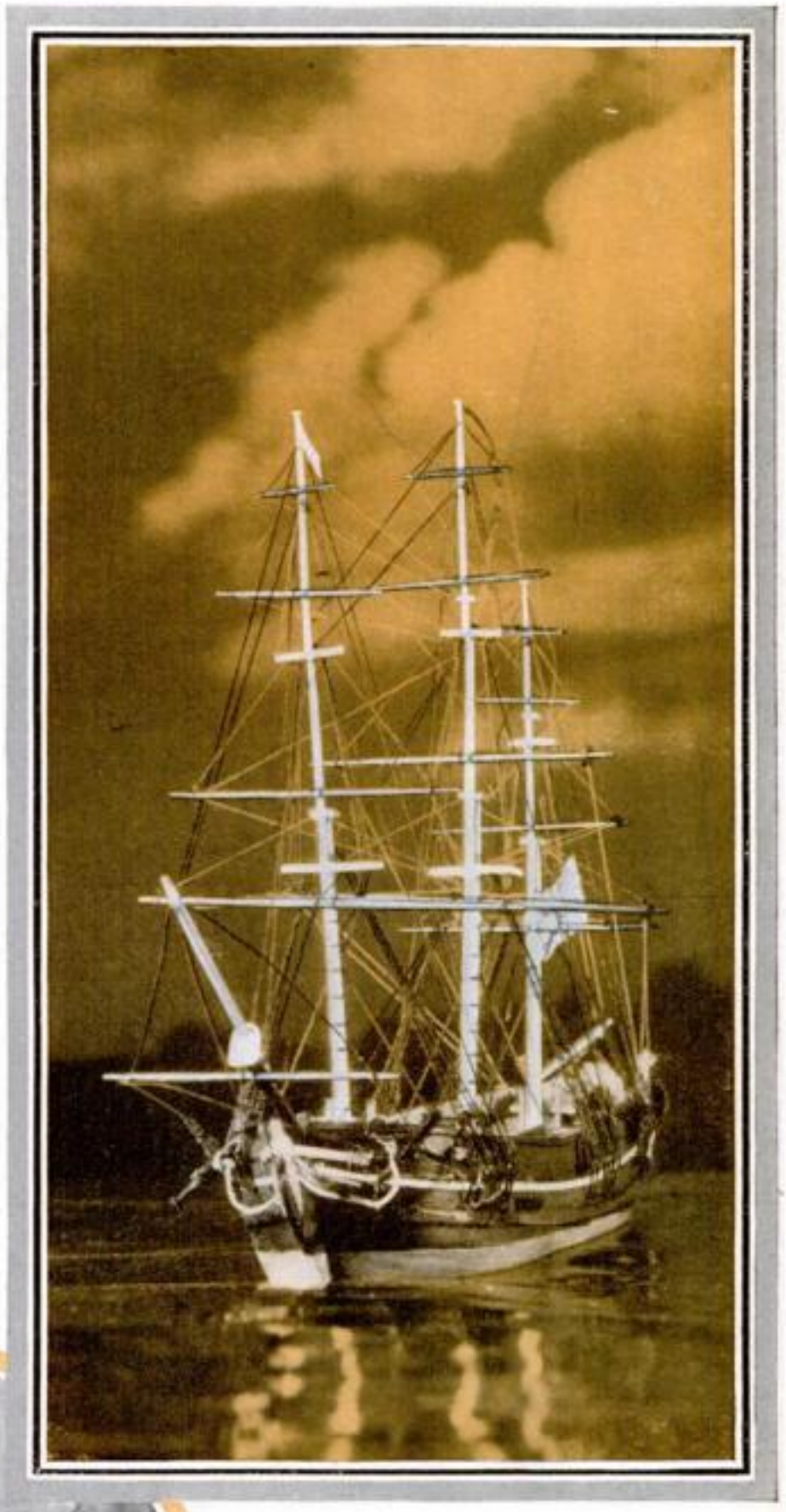
"Take your case, for instance. Your motor ran swell, but it wouldn't drive the rear wheels on a hill. Why? Look at these friction surfaces. They're worn down smooth, and are only about half as thick as they should be. Of course, it wouldn't bind between the pressure plate and the flywheel. It *(Continued on page 68B)*

Gus says:

Even a car can have too much of a good thing. Overloading a differential with lubricant doesn't do any good, and it can do a mess of harm. Nine times out of ten, the lubricant is forced through the rear axle onto the brakes, and it spoils the linings when it soaks into them.

HOW TO BUILD A MINIATURE MODEL OF H.M.S. *Bounty*

The ship on which was staged the most famous mutiny of the sea



You have read about the *Bounty*. Here she is, lying becalmed—not the real ship with her mutinous crew aboard, but a miniature model such as any reader can build himself. When photographed in so natural a setting, the model is as picturesque and realistic a little ship as any model maker could wish

FOR nearly 150 years the mutiny on the *Bounty* and Captain Bligh's 3,618-mile voyage in the ship's open launch have been one of the world's most thrilling true stories of the sea. That tale has recently been retold so skilfully in three popular books that the little *Bounty* is better known and more famous than ever. Many readers have therefore called for plans to build a model of her. Well, here she is!

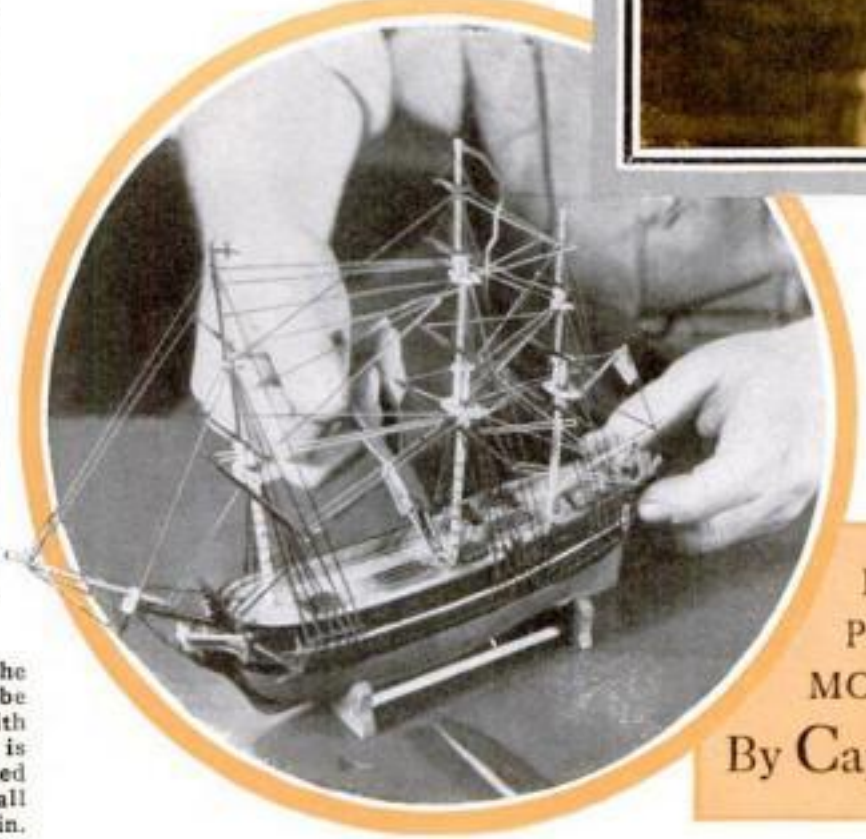
The model is in miniature form, constructed and rigged as simply as possible so that a beginner may try his hand at making it and so that the work will not take too long. The scale of the model in relation to the real ship is 1/12 in. equals 1 ft.

When Bligh was commissioned to find a ship with which to proceed to the Sandwich Islands, where he was to gather young bread-fruit trees and take them to the West Indies, he chose the merchant trader *Bethia*, built at Hull in 1784. She was only 90 ft. 10 in. long, 24 ft. 3 in. in beam, with a hold 10 ft. 3 in. deep.

The British navy purchased her, and altered and rerigged her in navy fashion, but, on the advice of Bligh, with a lighter rig. She sailed in 1788 with a crew of forty-six in all. She had four 4-pounder guns on the quarter-deck, six swivel guns on the after-deck, and two forward. I omitted the eight swivel guns because they would probably be shipped only as required.

To make the hull, take a piece of pine (or balsa) 1¾ by 2 by 7½ in., or thinner pieces to build up to 1¾ in. in thickness. It can be made of ⅜-in. layers or lifts as with the larger models. If you prefer, the hull may be cut off at the water line and set in a plastic sea.

Cut the block down vertically to the outside lines of the half-breadth plan. These lines are about the same as the deck plan, but slightly wider amidships to allow for the tumble home. Next cut the block to the heavy profile lines shown on the sheer plan. Make cardboard templates from the body plan, and shave the sides of the hull un-



Adding the final details. The size of the model can be judged by comparison with the hands. The hull block is 7½ in. long and the finished hull 8½ in. long. The over-all length is 11½, height 8¼ in.

Designed especially for the POPULAR SCIENCE MODEL-OF-THE-MONTH CLUB

By Capt. E. Armitage McCann

A close-up view of the rigging of the model, slightly enlarged, to show the lower mast tops and caps. The masts from the tops up to the caps are filed square and the caps fit over them

til these fit on at their respective stations.

From hardwood or semi-hardwood, such as gum or whitewood, cut the keel, stem, and combined sternpost and rudder. Glue these on and also nail them, if possible, with small pins after drilling holes. The stem can come up only to the bowsprit, the small toppiece may be added after the latter is in place. The hull, up to a point ⅛-in. above the water line, rounds in to the sternpost. From there up, it is almost flat across. At line *d* it becomes the full width of the hull.

For the bulwarks cut two pieces of cardboard (such as five-ply Bristol board) to the shape shown; also cut thin cardboard strips and glue them to the top edges. Glue the bulwarks into rabbets cut or filed in the sides of the hull.

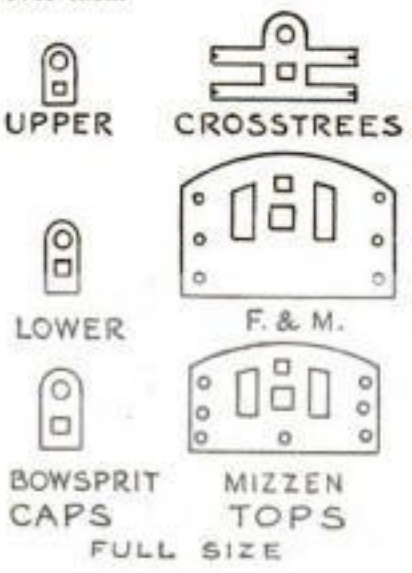
To go across the stern, cut pieces of cardboard to the shapes shown, glue one on the other, and color as shown with India ink or black paint. The windows can be cut right out and transparent cigarette wrapping glued behind. This piece glues across the stern, with its top edge coinciding with the bulwarks and its ends extending a little beyond them. The insides of the bulwarks and taffrail can be painted a light buff.

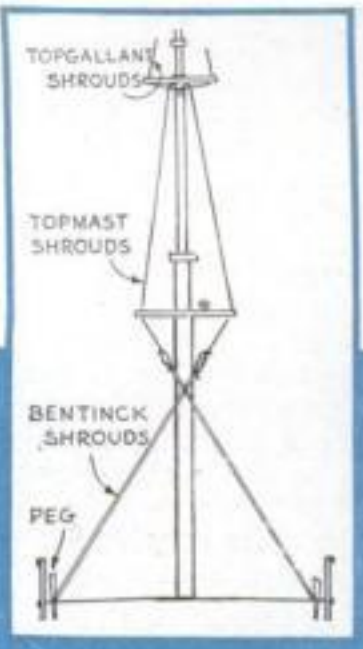
The heavy moldings (wales) I made from chair-caning spline, but two thicknesses of cardboard will serve. The quarter badges, or windows, can be made like the stern board and glued on. The figurehead represents a lady in a riding habit, although so modestly dressed she will have to straddle the beakhead. It can be carved, but an easier way is to make two figures of cardboard, glue the heads together, and glue the body on either side of the beak, which may be shaved a bit thinner. The trail boards can be in one piece with the figures, their forward ends being glued to the beak. The remainder sweeps in a concave curve to the hull where the after ends are glued. Holes are bored through these ends for the hawse pipes. Figurehead and trail boards are painted white and black as shown.

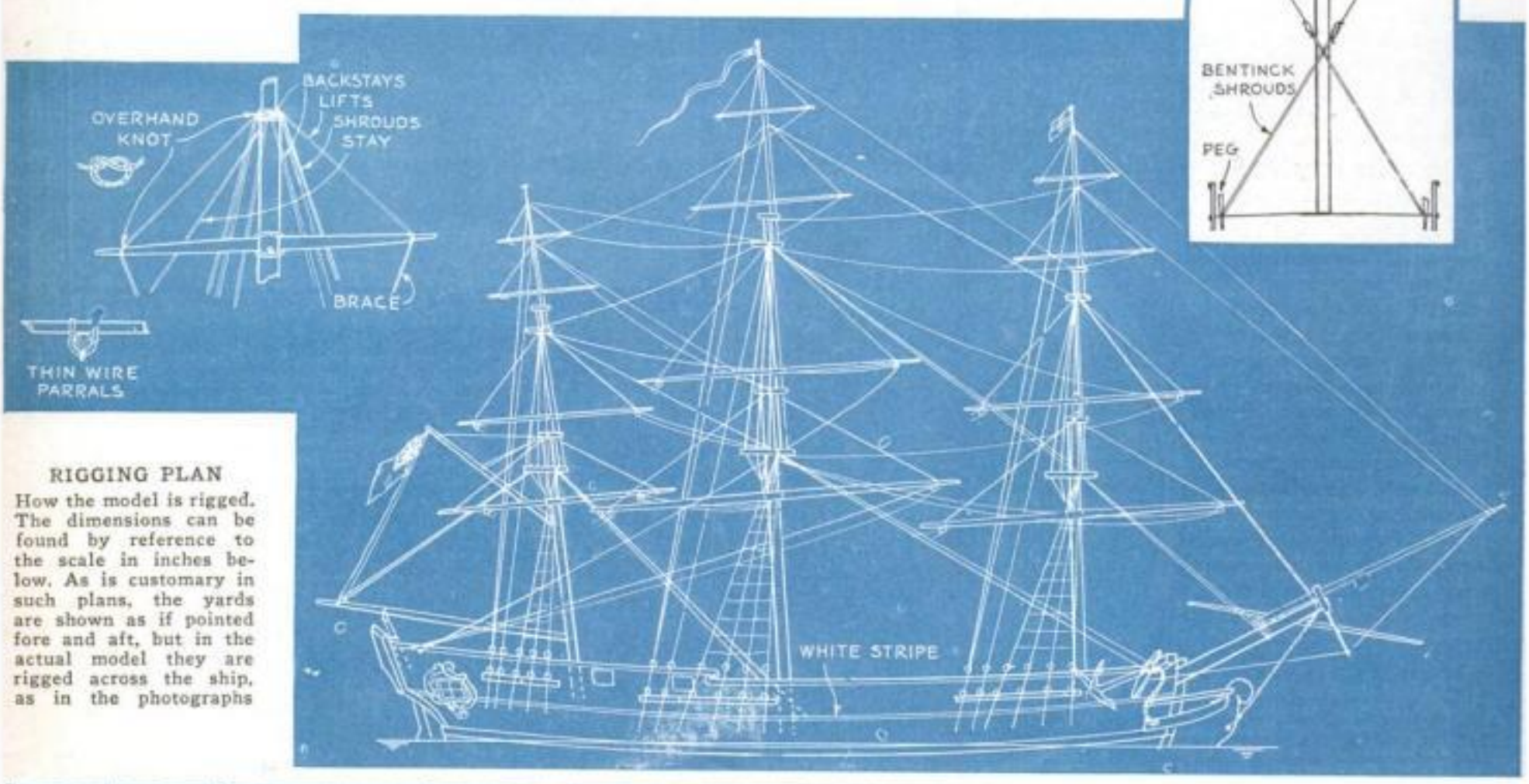
Cut notches in the bulwarks and nail the catheads to the forecastle deck. Also make three pairs of channels as shown and glue and nail them to the hull where indicated in the rigging plan.

From the highest available part of the beak to just under the catheads glue white strips of wood about 1/16 in. square to form the hair rails.

The hull up to the water line can be painted to represent copper, or it can be coated with copper bronze, with some







RIGGING PLAN

How the model is rigged. The dimensions can be found by reference to the scale in inches below. As is customary in such plans, the yards are shown as if pointed fore and aft, but in the actual model they are rigged across the ship, as in the photographs

green rubbed in. Above that all is black, except the ornaments. The white stripe is just a strip of paper glued on after the painting is done.

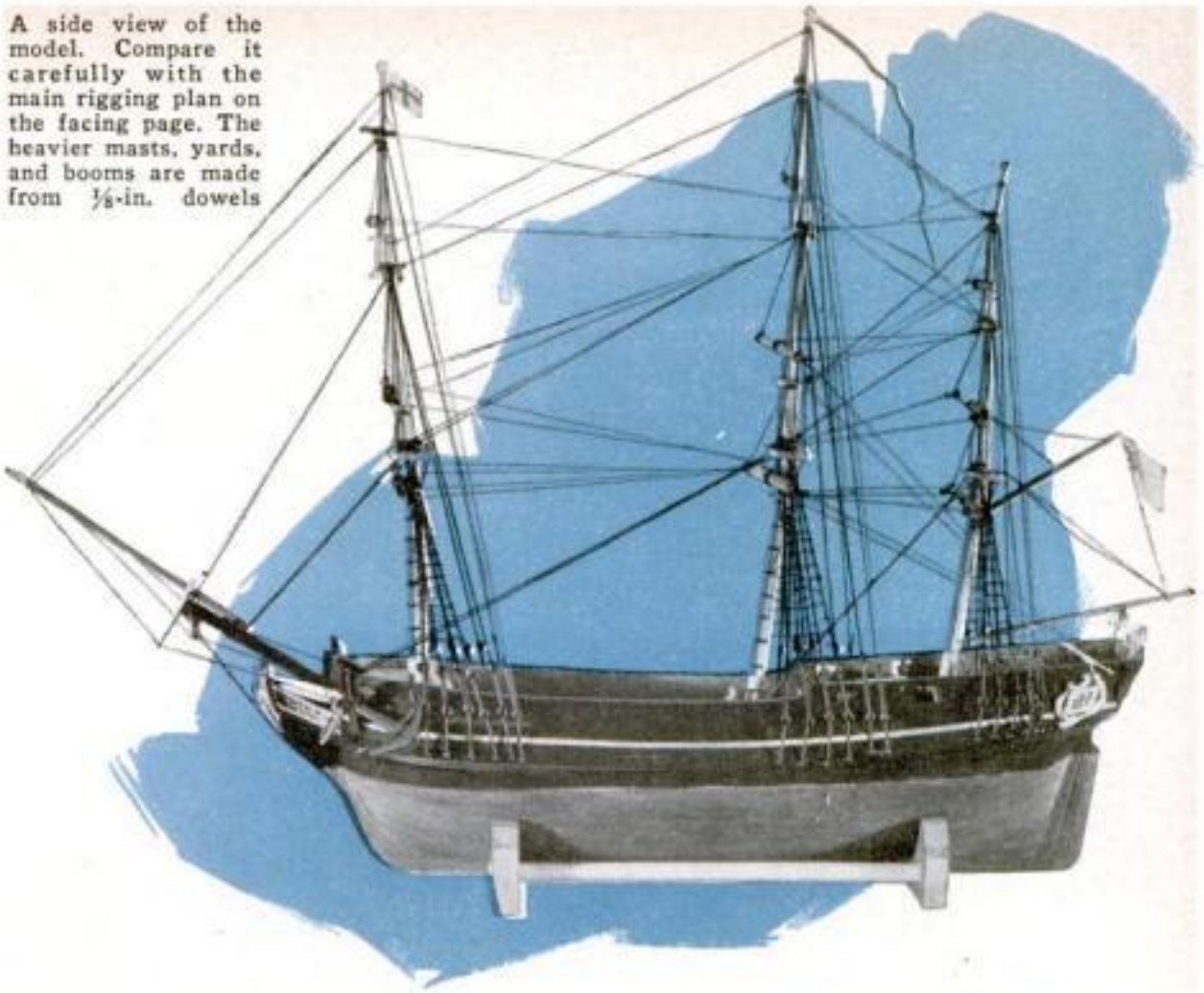
Some kind of stand may well be made at this point. That shown consists of two uprights cut to fit the hull at stations III and VII and joined with two 3/16-in. dowels. See that the model sits truly upright.

Gumwood serves nicely for the deck fittings, but stained whitewood will do. The hatches and skylight are all made from a piece 3/32 in. thick. The hatches gratings may be drawn with India ink and a pen after the hatches have had a coat of shellac. The top half of the skylight is cut to the shape shown in the detail and then painted to represent windows.

The *Bounty's* steering gear consisted of two standards with a barrel and rope between, but for neatness and simplicity I boxed mine in. An easy way to make the wheel is to draw it on a piece of thick transparent material such as is used in photoframes, cut away the outside only, and fasten with a ½-in. pin.

The three sets of bitts are pieces of 1/16-in. stick with the crossbars half-lapped into the uprights. The two stern lanterns I made by gluing large beads and small beads on pins. The gun carriages are cut from 5/32-in. square wood, and the guns are ¾-in. lengths of doctor's applicator sticks, slightly tapered, with a pin through them for the trunnions.

If you have never built a model before, do not be frightened by the nautical terms



A side view of the model. Compare it carefully with the main rigging plan on the facing page. The heavier masts, yards, and booms are made from ⅛-in. dowels

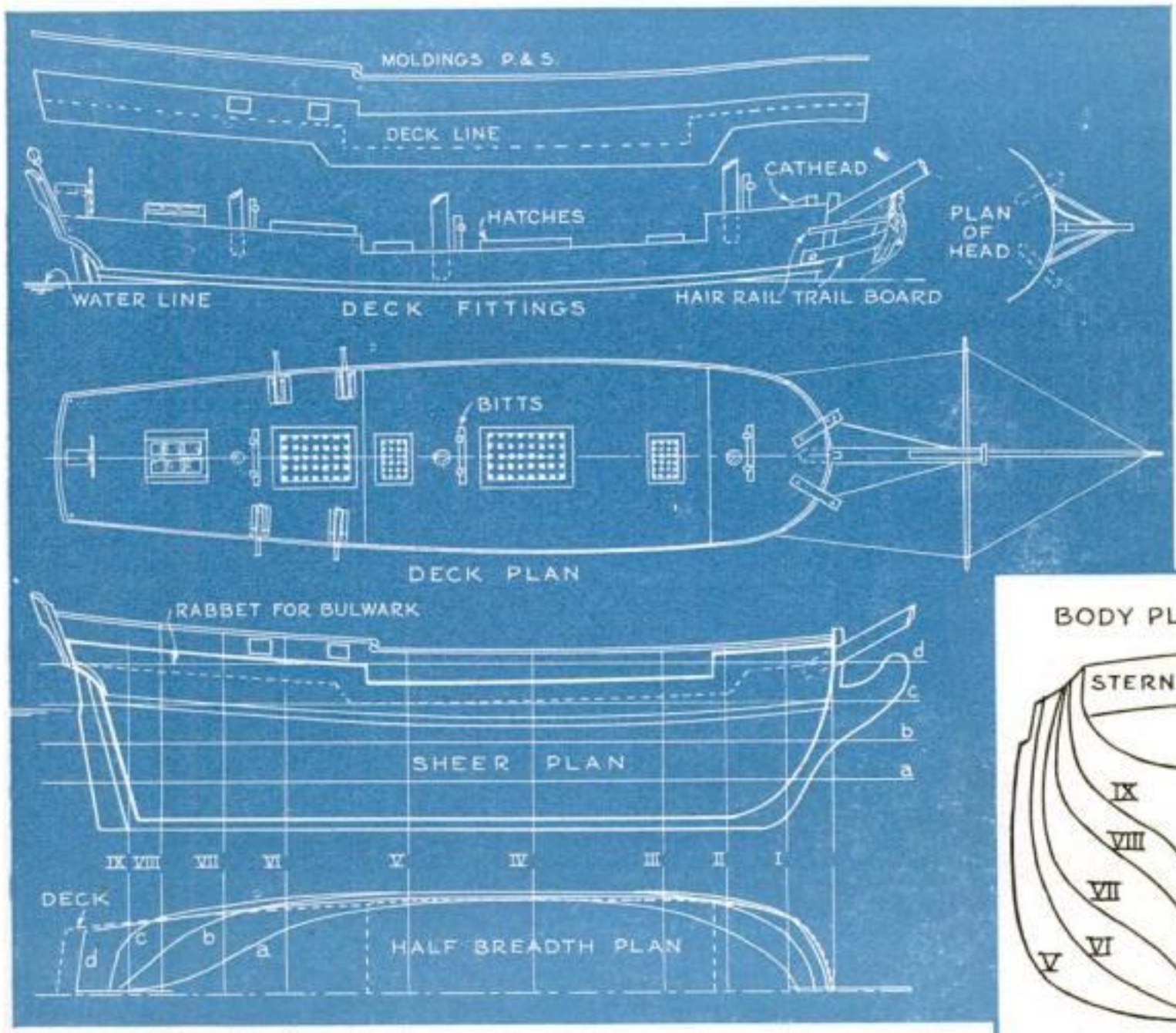
which are used in the following instructions for rigging the *Bounty*. The words are clearly defined in all large dictionaries, and many dictionaries and encyclopedias have diagrams showing all standard parts of ships. Even if you should fail to identify some of the parts accurately, just follow the drawings and photographs. You cannot then go far astray.

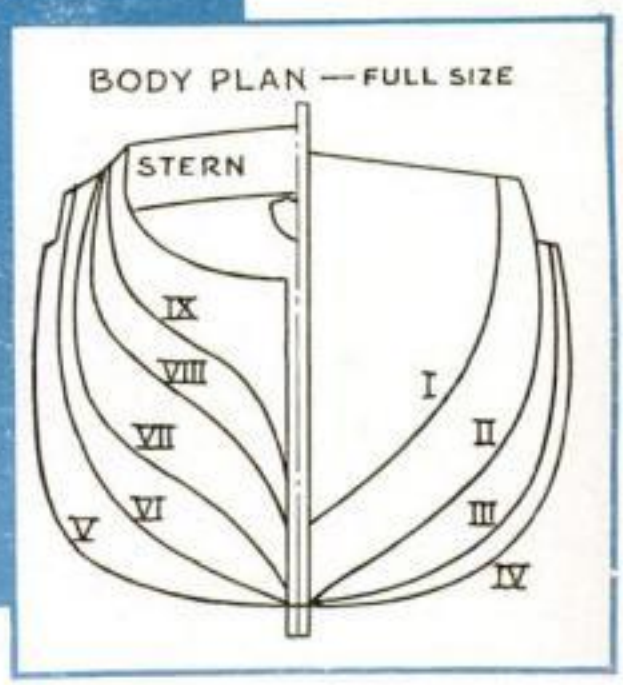
The heavier masts, yards, and booms are made from ⅛-in. dowel sticks, and the lighter ones from applicator sticks. Their dimensions can be scaled from the rigging plan on the preceding page.

Bore holes for the lowermasts and bowsprit at the angles shown, being very careful that they are in line with the stem.

I made my tops, caps, and crosstrees from 1/16-in. thick white celluloid, but fiber or even cardboard will do.

The jib boom is brown (pitch-pine color) with a white tip. The lowermasts are white (with black bands if you like). The topmasts and topgallant masts are brown, except where they double with the other masts. The *(Continued on page 84)*





The hull lines, deck plan, profile view of deck fittings, and bulwarks drawn to the same scale as the rigging plan on the facing page. At the right, however, the body plan is given full size

Plants Flourish in Glass Base of Unique

Lamp Garden

No sunlight or watering is required—The shade is made to match by decorating it with real ferns and flowers

By JULIA I. FOX

The real beauty and novelty of a lamp garden can be realized only when seen illuminated. The shade consists of two pieces of paper with pressed flowers between

MY HUSBAND and I have developed lighting fixtures of various kinds, and the one that has probably aroused the most interest is the lamp garden illustrated. Plants thrive without attention within the base, which in this case is a large glass bottle known as a "balloon demijohn." The shade is also unusual because it is decorated with real ferns and flowers to harmonize with the lamp base.

The neck opening of the bottle is about 1½ in. in diameter, and through this is dropped a mixture of three parts rich earth to one of gravel, and one cup of powdered charcoal. Enough water is poured in to moisten the earth thoroughly. Should mildew appear on the plants, the plug can be removed from the neck of the bottle for a sufficient period to allow the excess water to evaporate; and if the plants appear too dry, small amounts of water can be added. The lamp illustrated has not been opened for ten months, and the plants have died down and come up as they would in their natural habitat.

Most people think we use some form of magic to get the plants in the bottles, but it is simple enough. We made a special tool from a 2-ft. length of heavy iron wire. The ends were beaten flat, and one was bent at right angles and notched. Small plants and mosses are dropped through the bottle neck, holes are dug with the long tool, the plants are pushed into them with the notched end, and earth is piled around them and patted down.

A variety of plants may be used. We have been successful with the delicate maidenhair fern, as well as dogtooth violets, and many other wild and garden flowers. The shade illustrated at the right above has huge sprays of maidenhair fern, purple clematis, orange marigold, and Boston fern. This shade with its base is a fair example of the application of dynamic symmetry (P.S.M., Aug. '32, p. 98).

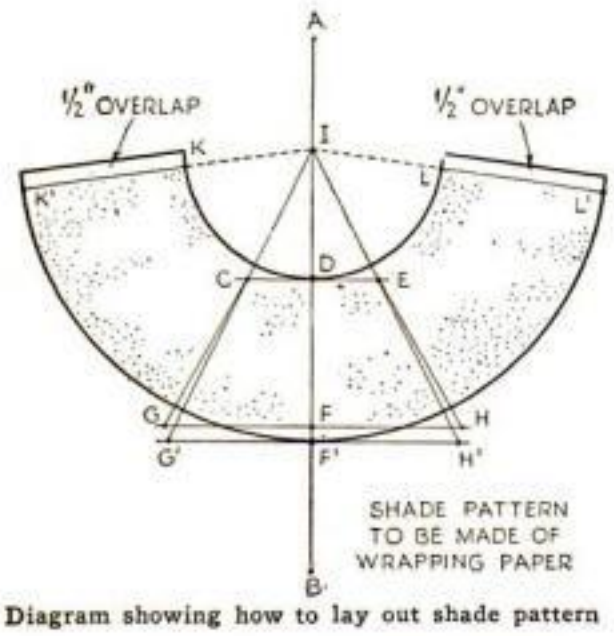


Diagram showing how to lay out shade pattern

Directions for making wire lamp-shade frames were given in a previous issue (P. S.M. Aug. '32, p. 94). We have not found it necessary to use side supports for our shades, even when they are as large as the one shown (14 by 15 by 24 in.). Tinned wire is not used, but we sandpaper the iron wire wherever a joint is to be made. A small alcohol blowtorch will be found most useful for soldering the joints, and a soldering flux is used by us even with cored solder.

THE shade pattern is made as follows: Select a smooth piece of wrapping paper, thumb-tack it to a board, and draw a perpendicular line *AB*. Next select a point *D*, on AB, and draw *CDE* through it at right angles to the original line. *CD* and *DE* are laid off equal to the radius of the top circle of your frame. The depth of the frame *DF* is then laid off on *AB*, and another line *GFH* drawn at right angles. *GF* and *FH* are made equal to the radius of the lower shade ring. Connect *G* and *C*, which will give the distance on the surface of the shade between the two rings of the frame. Lay this distance off from *D* on the vertical line, which will locate the point F^1. Again draw a line through F^1 at right angles to *AB*, and lay off G^1F^1 and F^1H^1, which are again equal to the radius of the lower ring. Draw lines through the points G^1, *C*, and H^1, *E*, which, when extended, cut the vertical at a common point, *I*.

With *I* as a center, describe arcs with *ID* and IF^1 as radii. Obtain the points K^1 and L^1 by laying off half the circumference of the lower ring on the arc, starting at F^1. The points *K* and *L* are obtained in the same manner by starting at *D* on the upper arc and using half its circumference to locate them. You are now ready to cut the pattern, but be sure to add ½ in. at each end for the overlap.

THE shades are made from a good grade of white paper (bond paper is not satisfactory because of the watermark). After two sheets have been cut from the pattern, the flowers, which have been pressed under a weight between two sheets of blotting paper for a few days, are arranged on one sheet and fastened down with cellulose household cement. Then the entire sheet and flowers are covered freely with the cellulose cement, and the outer sheet of the shade put in place, pressed down by hand until entirely smooth, placed between two smooth boards, and weighted with a single layer of average size books. A great weight is not desirable as it may cause the color from some of the flowers to run into the shade.

After the shade has been dried for not less than eight hours, rub both sides with a rag saturated in boiled linseed oil. If a darker shade is desired, a few drops of oil stain of the proper color can be added to the linseed oil. Now wipe off all surplus oil with a fresh rag and sew the shade to the upper and lower rings, and fasten overlaps with brass brads. Finish top and bottom with a harmonious shade of bias binding, fastened with celluloid cement.

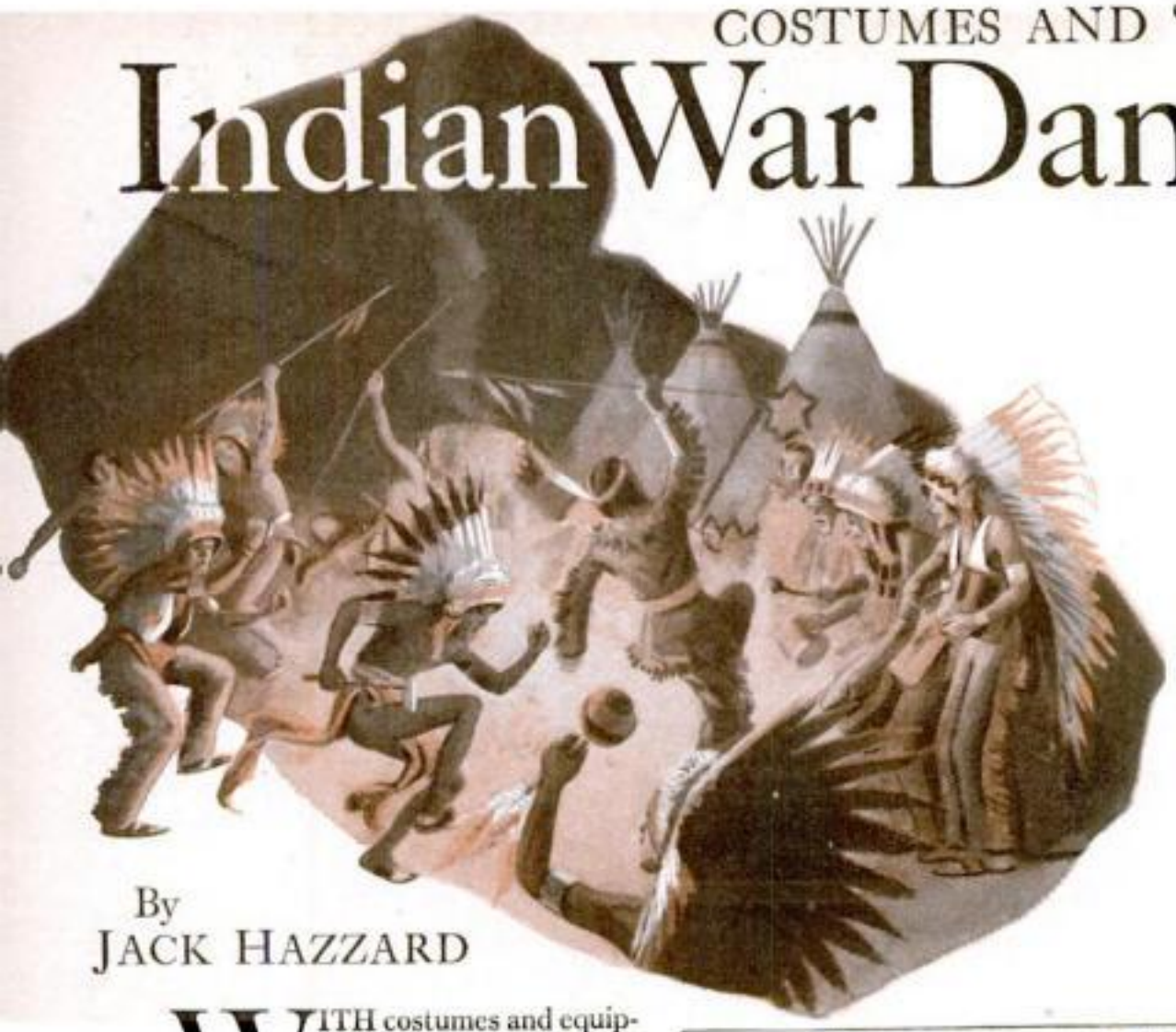
The flowers keep their colors very well, as the shades are practically air-tight, although there may be some fading, particularly with the greens. When this happens, however, the effect is still natural and pleasing.

A great deal of scientific data has been collected within recent years on the stimulating effect of artificial light to plant growth (see P.S.M., Sept. '33, p. 19, and Oct. '33, p. 33). If potted plants receive a few hours of artificial light in the evening, it is not necessary to place them close to a window where they would receive direct sunlight. Plants needing much sunlight outdoors naturally require more artificial illumination indoors.

April 1935

COSTUMES AND "PROPS" FOR AN

Indian War Dance Show



Old inner tubes are used for drumheads, tomahawks, knives, and lance points— Headdresses and buckskin suits also easily imitated

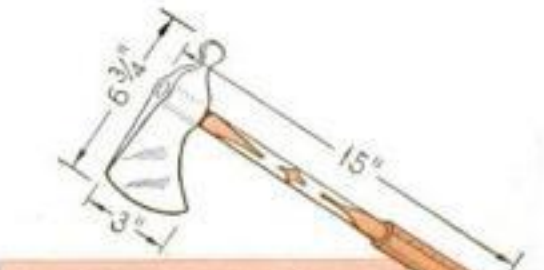
By
JACK HAZZARD

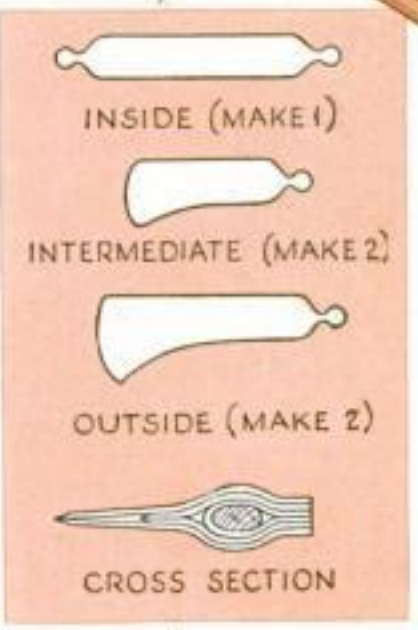
WITH costumes and equipment made mainly from old inner tubes and other discarded materials, any group of boys can put on a thrilling Indian war dance show. All sorts of Indian leather work, drumheads, and even realistic looking tomahawks, knives, and lance heads may be simulated with rubber. Real Indian materials, on the other hand, are expensive, hard to get, and require much more time and skill to make up.

Drums that give a convincing Indian sound are made from large oyster tins or other cans headed on both ends with rubber and painted brilliantly. Cut out the bottom with ¾-in. allowance and hammer in the edge to strengthen the end. For the head, first cut twelve or thirteen sections like rubber bands from an old tube. Then split the remainder of the tube and cut off a piece large enough to cover the end of the can. Hold it in place over the end of the tin, and work a band into place. After stretching the head somewhat, put five or six more bands in place. Now place the palm of the hand on the edge of the drumhead and push, pull, and roll the head toward the binding. Repeat this at intervals, turning the drum round and round, and finish with a few two-handed downward pulls. Cut away the unneeded part of the head, but leave a grip all around for future tuning.

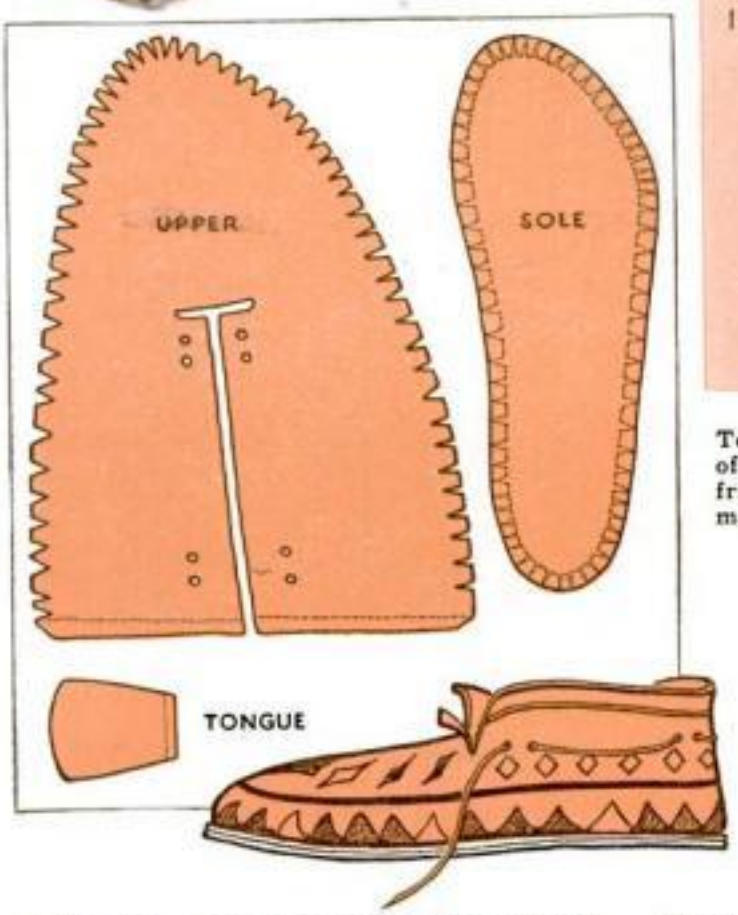
A whole drum corps can be equipped in this way. A drum with one head and with the bottom of the can left in sounds like a kettle drum; with one end open it produces a high effect; with two heads, it gives the typical Indian boom; and with hard-twisted cords stretched over the bottom head and looped through the bands, it has the snare-drum rattle needed for a drum corps.

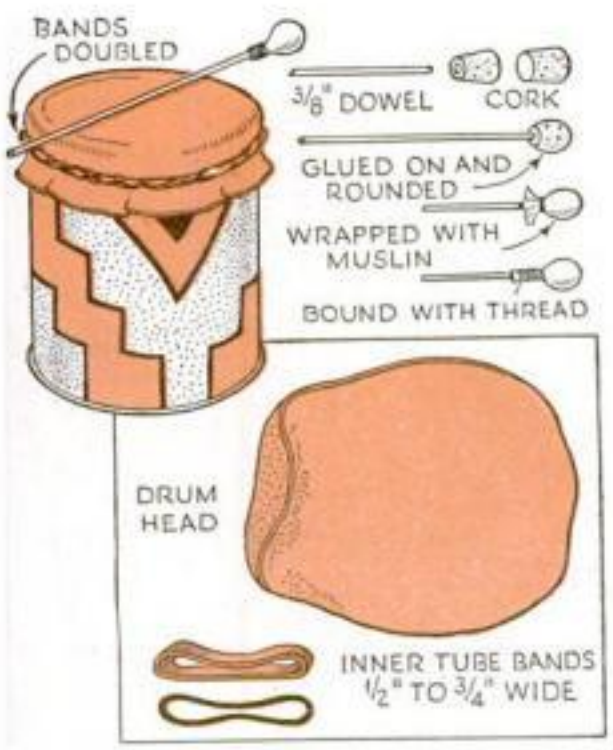
Moccasins, too, may be made from inner tube. The pattern illustrated must, naturally, be adapted to the foot of the wearer. Use gasoline to clean all the tabs along the edge of the upper piece and a wide strip along the edge of the sole. Dry well. Fasten a tab or two at the toe and gauge to see that the heel lap will come at the right place. Working first on one side and then the other, *(Continued on page 94)*



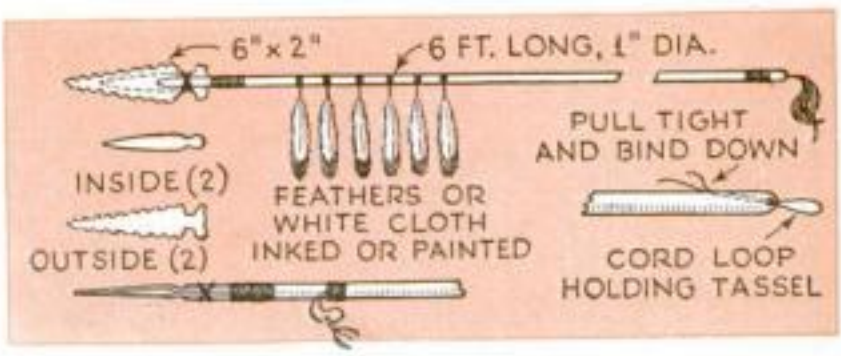


Tomahawk heads are built from pieces of rubber cemented together, and the fringed grip is also rubber. Moccasins may be made from inner tubes as at left





Drums are large tin cans with rubber heads held on by bands sliced from an inner tube



Lances like this have a warlike look but are entirely harmless. The points and edges are trimmed thin after the cement has dried

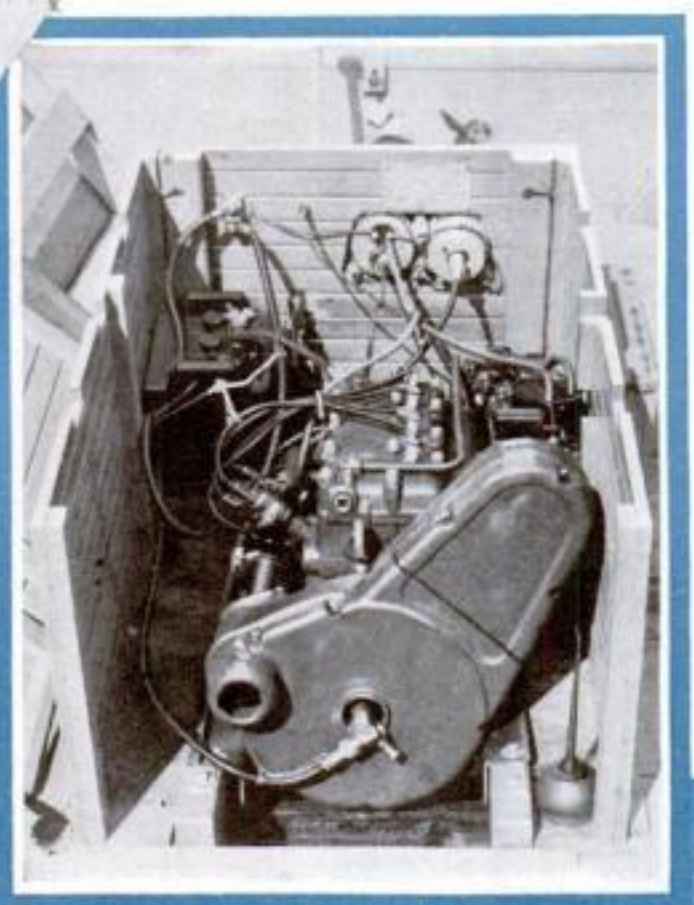
Plans for Constructing a
HEAVY-WEATHER

Motorboat

The Invincible Cape Cod Dory

By
Hi Sibley

Dr. Paul S. McKibben, dean of the School of Medicine, University of Southern California, in his dory, in which he goes far out to sea. Note roominess and extreme sheer



As shown below, the 40-H.P. motor in Dr. McKibben's dory is housed in a compartment held together with hooks. Top and sides can be removed as required

LONG a favorite with commercial fishermen who meet all kinds of weather far out at sea, the true dory is a practical boat for inland lakes as well. It combines many advantages, notably its roominess, its stanchness, and the ease with which it can be handled and launched in the surf.

The original dory design had no thwarts, so that a number of the boats could be nested on the deck of a fishing schooner. The model in the drawings is 18 ft. long.

In Fig. 1 are given deck plan and side view. For clarity, no battens or moldings are indicated on the former. The dory is shown with inboard motor installation, but it has a mast step for rigging a sail in emergencies.

First make the oak stem approximately as laid out in the squared diagram, Fig. 7. This is rabbeted ½ in. deep for the planking and is secured to the keelson with an oak knee. Bottom boards and keel are put on after the side planking is completed. The transom is cut from 1½ in. oak or mahogany as in Fig. 9, the sides and bottom being beveled as required.

Next lay out the frame profiles, Fig. 8, full size on paper or on the shop or garage floor with chalk. Use ⅞-in. oak for the ribs and cross member of each. The two forward frames, *A* and *B*, have a crowned cross member on top to support the short deck, Fig. 5, but all the other frames are open. A typical frame *E* is given in Fig. 6. Note that the oak knees are secured with two bolts, through rib and bottom member, and two screws. The original Cape Cod dory has a metal yoke at this point.

In cutting the ribs, leave 3 or 4 in. of stock on the tapered ends so that temporary crosspieces can be used as braces until the side and bottom planking is installed. Also, the notches for the side battens should be about ¼ in. wider than the battens to allow for adjustment, since no two boards will bend exactly alike and it is impossible to give absolutely accurate dimensions at this point. Notches for the keelson and bottom battens, however, can be cut to fit exactly, and this should be done.

No dimensions are given for the motor mount, since there are several engines adaptable to this type of craft. A 20-H.P. four-cylinder engine will be satisfactory, and details for building the shaft log will be supplied by the motor manufacturer.

Planks ½ by 9 in. are used on the side. They may be pine or whatever material is available in your locality for boat building. A batten is back of the seam, secured with copper rivets spaced in pairs about 5 in. apart. The edges of the planks are slightly beveled to leave a narrow V-joint into which cotton lamp wicking is driven, followed by an application of marine glue. When this is dry, fill the joint with putty (Fig. 2).

The calking along the chine consists of lamp wicking twisted around small brads, the latter then being bent over and pounded in flush, as in Fig. 4. Marine glue is next applied, and the bottom planks are put on. Galvanized nails can be used for this purpose. In fact, no iron should be used in construction unless galvanized, and brass or copper is better where possible. The bottom is calked like the sides.

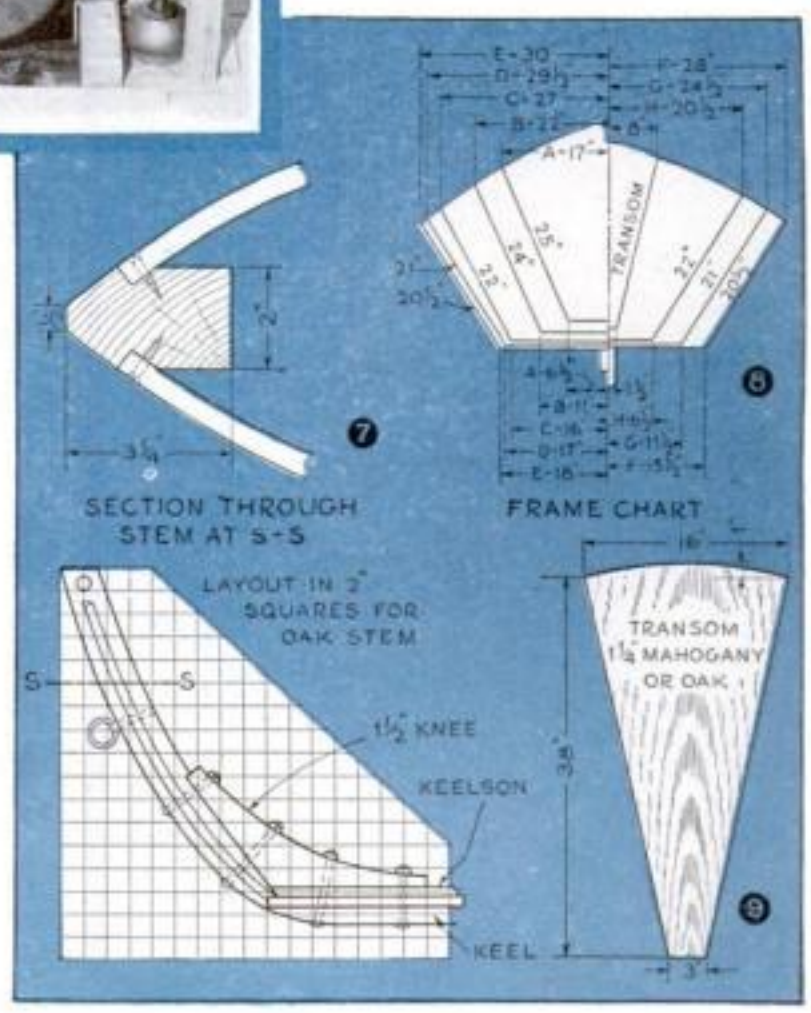


Chart of frame dimensions and details of stem and transom

The general constructional method is illustrated in Fig. 3. First, secure stem and transom to keelson, which is a ¾ by 3 in. board running the length of the bottom. The frames *A* to *H* inclusive are then spaced on the keelson according to the dimensions given in Fig. 1, deck plan, and are held in place by temporary braces. The top side plank is then put on, after the frame has been turned upside down. This brings the frame to the upcurved shape. Other side planks and battens are added, and the bottom or lower side plank is planed flush with the chine batten. Cotton wicking is inserted as in Fig. 4, and the bottom completed. A molding around the gunwale and the inwale strip are finally applied.

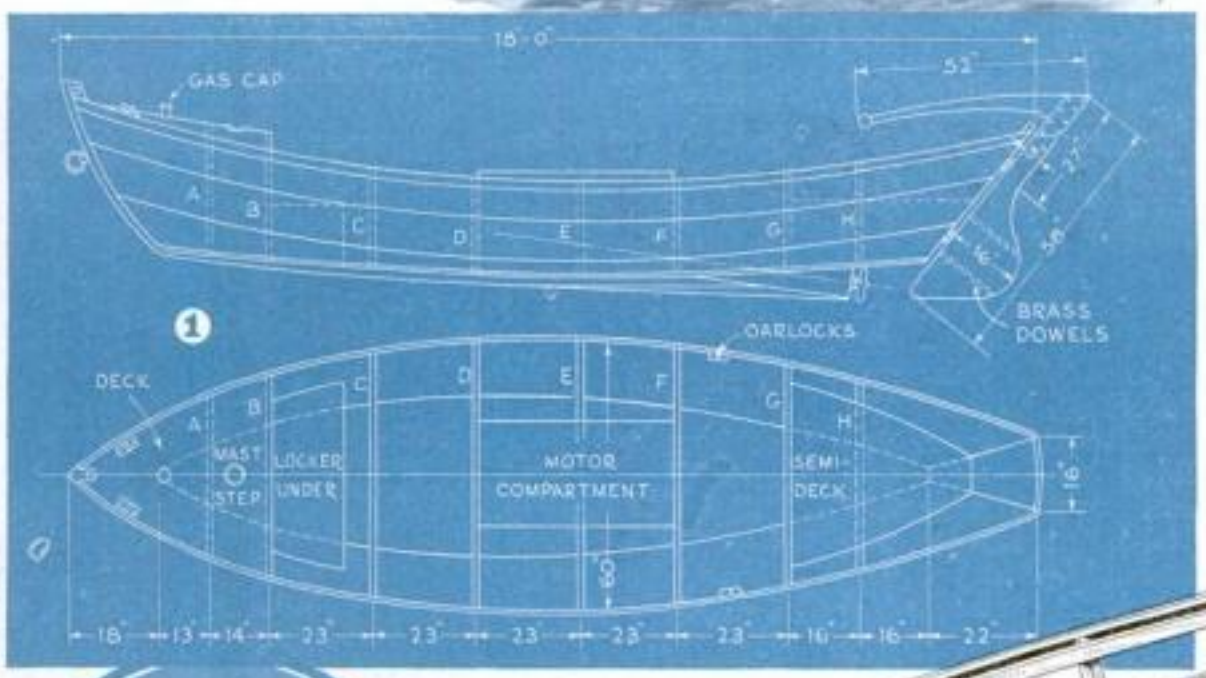
Here is part of a dory fleet on Newport Beach, Calif. The loaded boats are easily beached

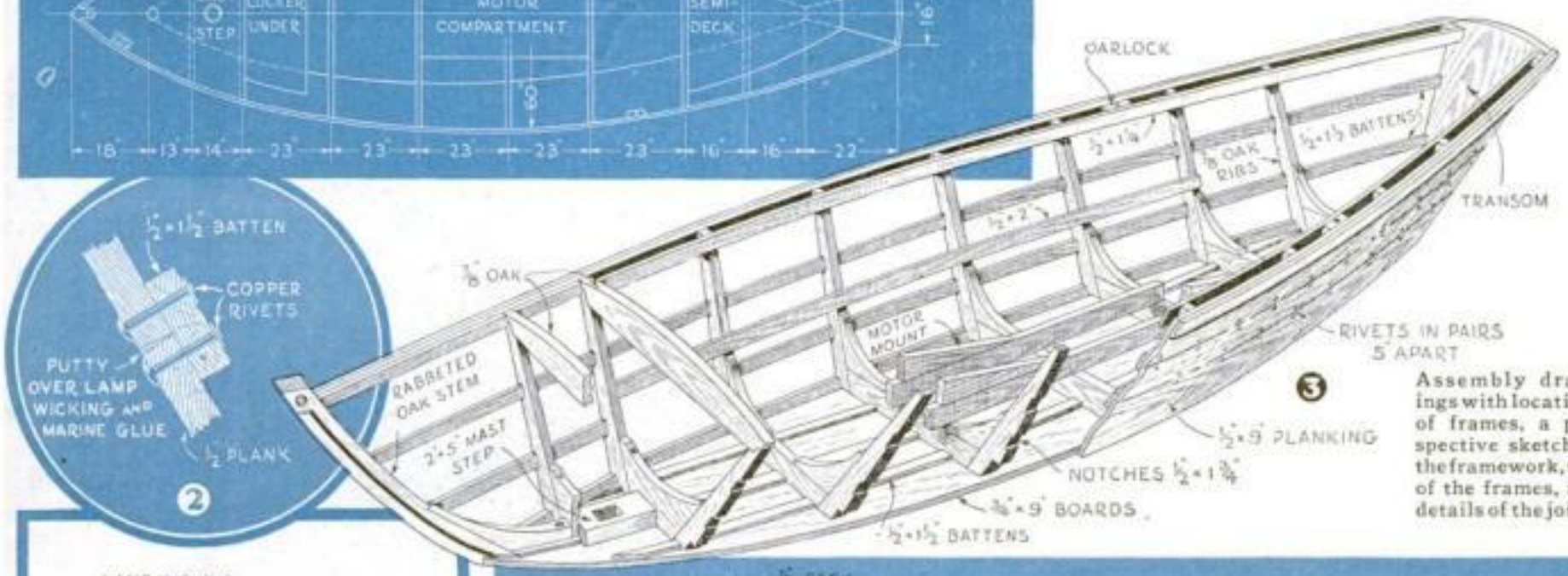
This boat is 20-ft. long but dories as small as 14 ft. are built for use in rough water

The forward deck is of ⅝ by 2 in. planking. This is covered with canvas after the deck has been varnished thoroughly. The edges of the canvas are drawn taut and tacked down, then covered with a molding as shown in Fig. 5. The fuel tank should be installed under the deck, with a suitable filler cap.

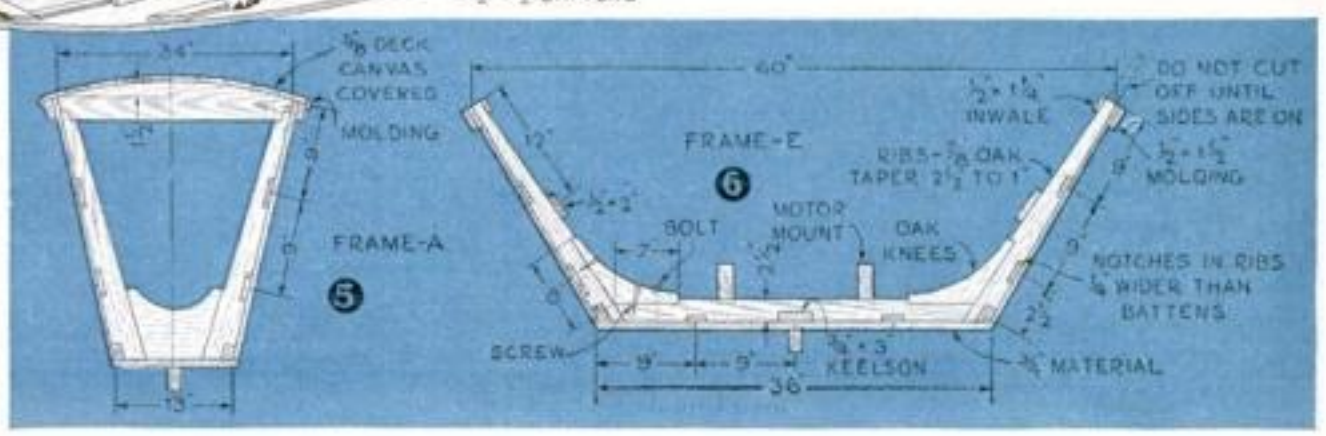
Make the rudder of 1¼-in. oak or hard pine with brass dowels through the wide part. The hangers and eyes should also be brass. A rather long tiller is necessary.

A deeper, permanent keel makes it possible to use this craft exclusively as a sailboat, but it is at its best as a power boat. The model shown in the photos is painted white above the water line and red below, with molding and rudder in natural wood finish. The bottom inside is gray and the sides are white.



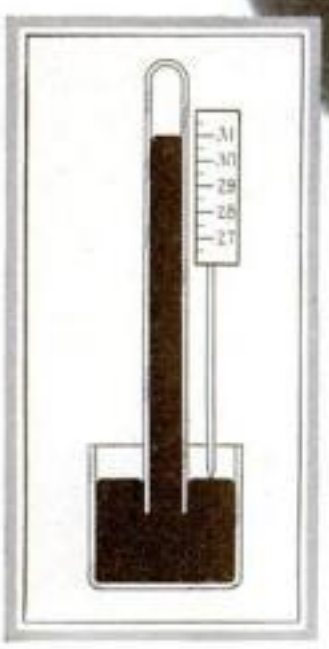


Assembly drawings with locations of frames, a perspective sketch of the framework, two of the frames, and details of the joints



Making a Mercury

FOR YOUR HOME



The most important instrument in weather forecasting is the barometer. It infallibly reports the "highs" and "lows" by what may be considered as a process of "weighing" the air. The principle of the mercury barometer is shown at left, the measurement being taken from the level of the mercury in the cistern to the top of the column. At the right is a simple homemade barometer

By EDWIN M. LOVE

IF THE barometer is falling, beware of weather! Sudden sinking of the mercury means lowered atmospheric pressure, which in turn usually presages storm—an inrush of denser air, cold or moisture-laden, to displace the lighter rising air. When the column regains its normal height, look for fair skies soon.

The barometer, in effect, weighs the air. To illustrate this, seal a glass tube at one end and fill it with mercury. If you close the open end with your thumb and upend the tube in a dish of mercury, some of the liquid metal will run out, leaving a vacuum above it. Air pressure keeps most of the mercury in the tube, the amount depending on the elevation, the temperature, and weather conditions.

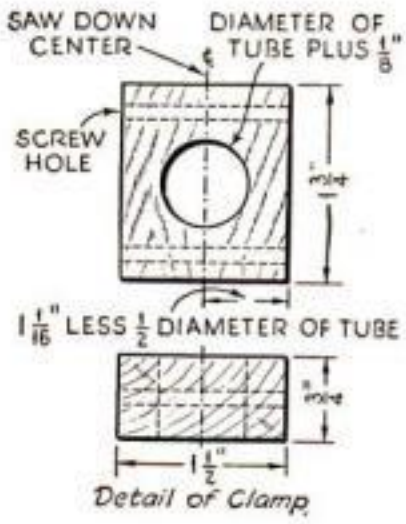
Since the height of the mercury column varies with the air pressure, and storms usually follow the movement of low-pressure centers across the country, it is evident that a barometer is essential to your back-yard weather station; and the mercury type, being so simple in construction, is a first-rate project for your home shop. Obviously, you must add to the tube and dish a rigid support of some kind equipped with guards to prevent breakage of the glass, but the labor of making it is almost negligible. You probably have a smooth board on hand that will furnish all the needed lumber.

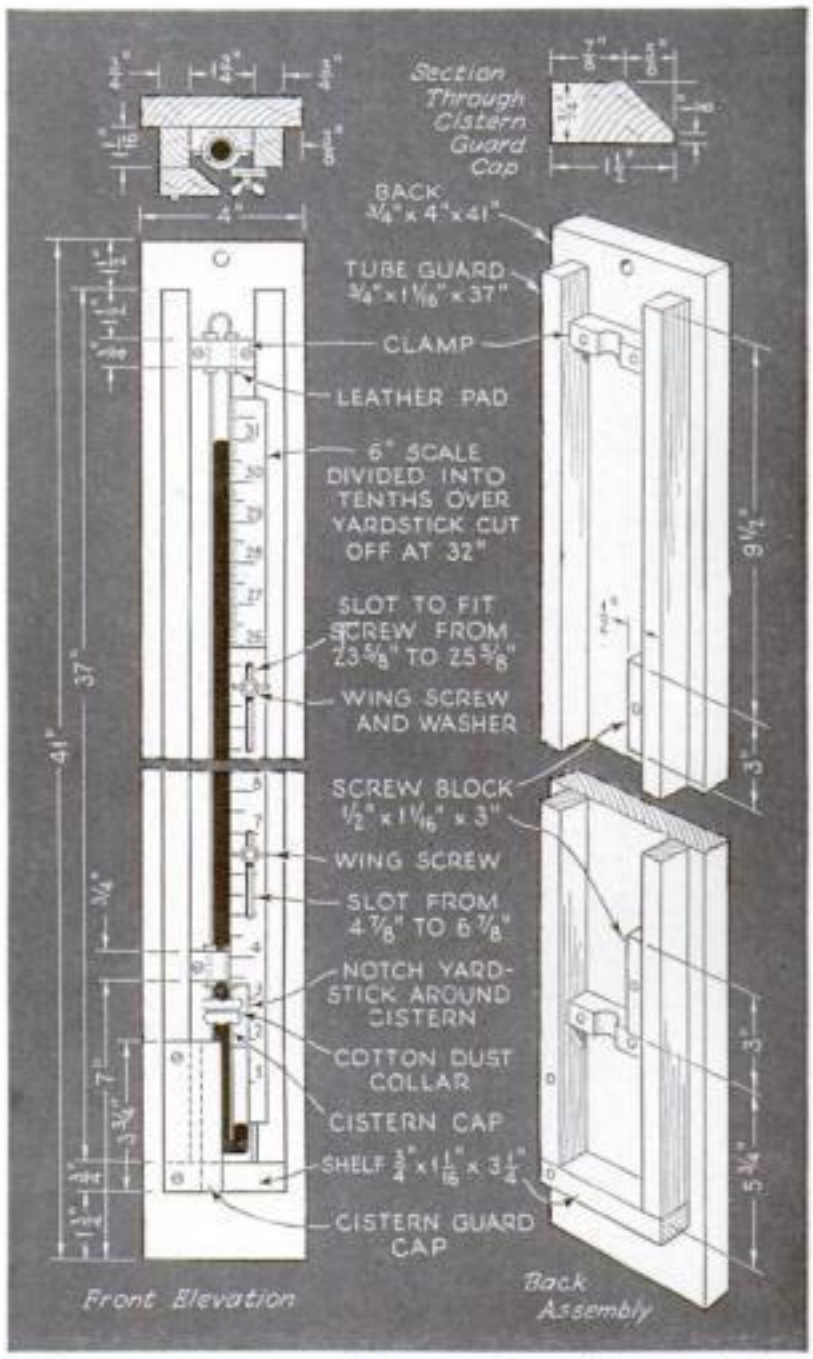
At a drug store purchase a round glass bottle about 1 in. in diameter and 3 in. high, fitted with a composition screw cap. A suitable glass tube also must be obtained. One easy way to get it is to buy a gauge glass of ⅜-in. bore and 3 ft. in length, which is stocked by most hardware dealers. This size usually sells for about 90 cents. Regular barometer tubing with one end closed can also be bought from dealers in scientific supplies. Mercury costs about $1.50 a pound, and 2½ lbs. will be required for this tube. If you can obtain a glass with an inside diameter of ⅛ in., only 9 oz. will be needed, and other sizes, of course, will be in proportion.

A suitable back is suggested in the drawings on this page. The guard strips may be varied in size, so long as the tube stands free, is protected from accidental blows, and yet can be easily read. To make the clamps, bore holes ⅛ in. larger in diameter than the tube (to allow for leather pads) and rip them through the center. Tack the halves to the backboard and drill the ends to receive screws. Cut tin strips to clasp the outside of the tube. Make the cistern guard cap, add the cistern shelf, and paint the assembly with two coats of boiled linseed oil.

Bore the bottle cap to fit loosely over the tube. As there is some danger of cracking the composition, it is best to drill a ⅜-in. hole and then enlarge it with a round file. If there is a metal-foil liner in the cap, remove it, for the mercury might attack it.

Filling the tube must be done with considerable care. Pouring the mercury in and stopping the opening with the thumb is all right for an experimental barometer, but it is not satisfactory for continued use, because, in filling, large numbers of air bubbles are trapped. Many of these





How to mount a mercury barometer. It consists merely of a glass tube and a small bottle or cistern set up on a board with a scale that can be adjusted to show the height of the mercury

Barometer

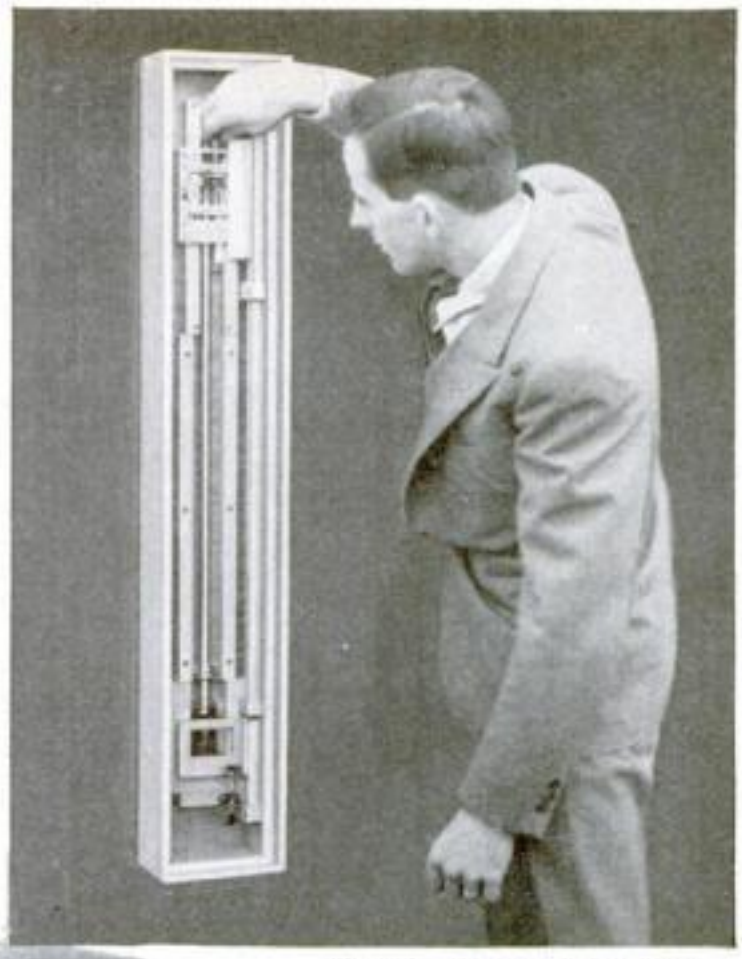
WEATHER BUREAU

can be worked out, but in spite of all possible care hundreds of tiny bubbles remain scattered through the column. In the course of time, some of these bubbles may work to the top and spoil the vacuum.

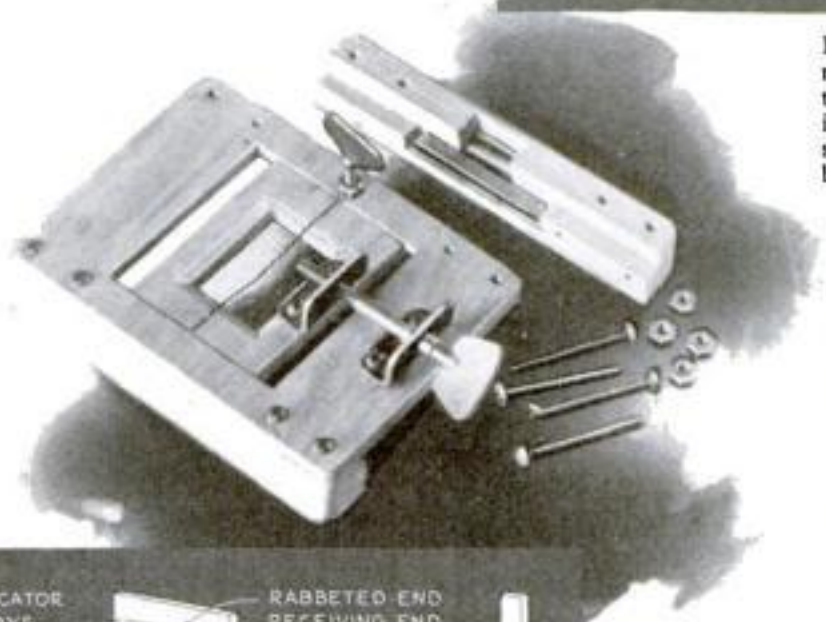
Fortunately, the filling can be done without much trouble. If you find it unhandy to do the job at home, you can probably get permission to work in your local high-school laboratory. First the tube must be sealed at one end. Warm it for some distance back from the end, moving it back and forth in the flame and rotating it with the fingers. Then concentrate on the very end, continuing to turn the tube until the glass softens. The closing can be speeded by pushing the glass inward with an iron rod. Continue heating until the glass runs together in a smooth blob.

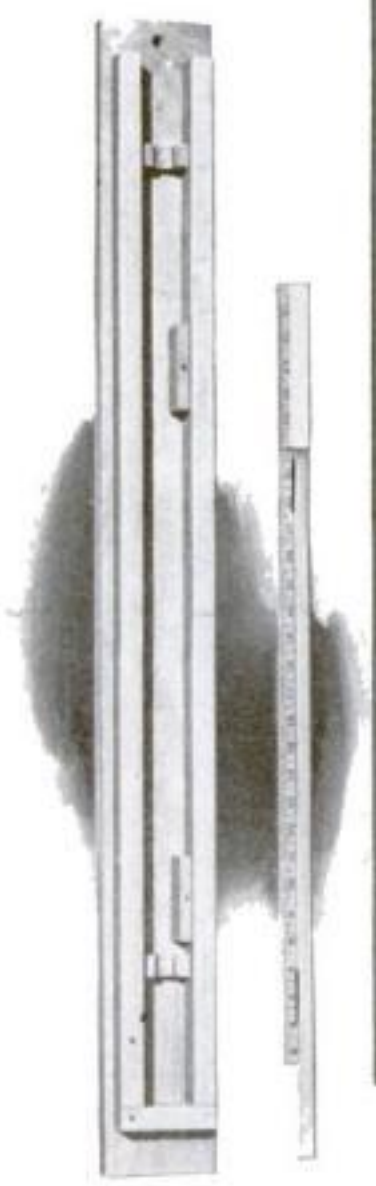
No matter how clean the tube appears to be inside, it must be considered dirty. To clean it, make a solution of 1 part nitric acid to 20 parts water, and nearly fill the tube with it. Cork with a rubber stopper and shake for a minute or so; then empty, rinse with tap water, rinse again with distilled water, and stand aside to drain for a quarter of an hour. Now fill the tube with strong alcohol and pour out, repeating eight or ten times, to remove the water, and drain for at least half an hour. The tube is then ready for use. For best results, however, the bottle should be treated the same way.

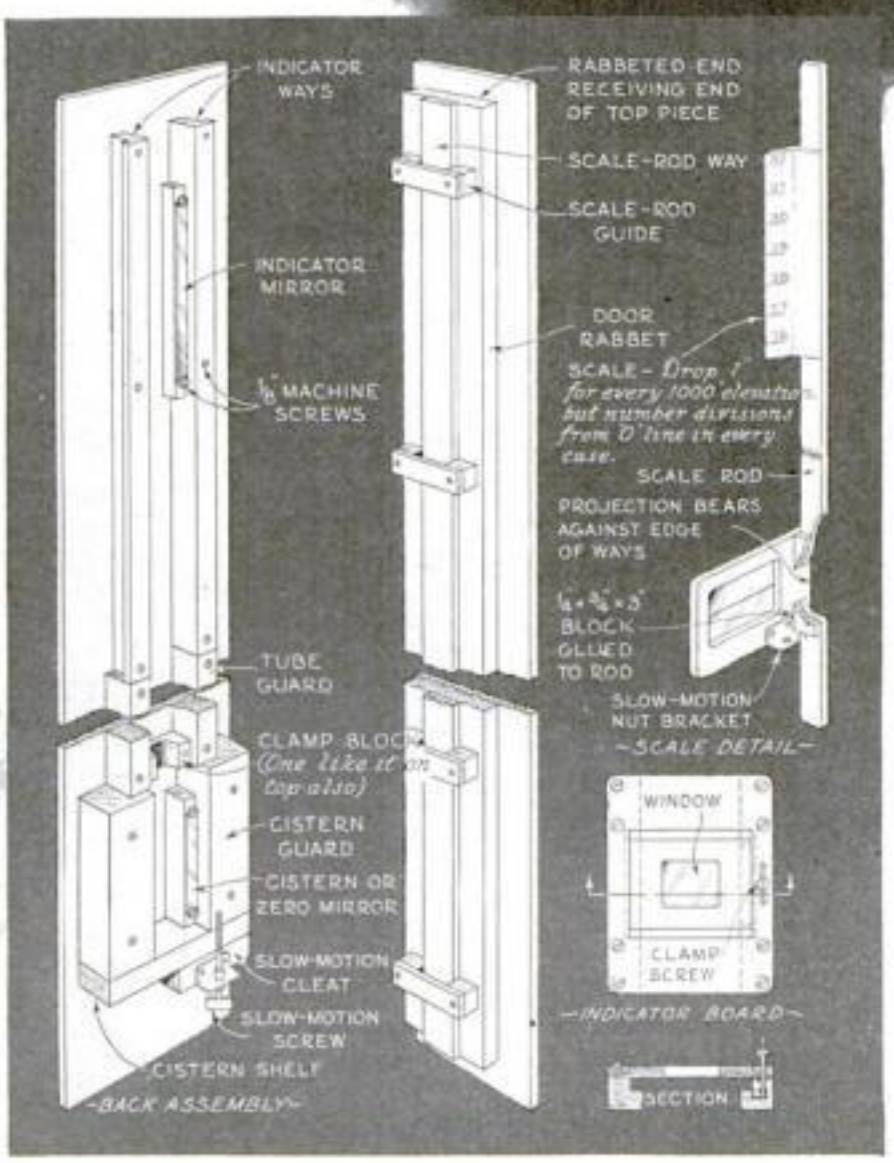
As there is some danger of spilling the mercury, it is a good idea to do the pouring over a large crock or enameled kettle. Warm the tube and a quantity of quicksilver, and, using a funnel, pour in enough to fill the glass 3 or 4 in. deep. Holding the tube lightly in the fingers, heat it gently in a Bunsen flame, turning and moving it up and down to prevent excessive local heating. As the temperature of the mercury nears the boiling point, air and moisture are driven out and form tiny silvery-white bubbles, which coat the interior of the tube and give it a frosted appearance. These bubbles enlarge, but after the mercury boils for a while they disappear entirely. Further boiling takes place with sharp clicks as the metal spashes about, an indication that it has continued long enough. Now add a fresh quantity of warmed mercury and repeat. You can easily see the line of separation between the treated mercury and the new. Continue the process until the tube is nearly filled. The last 2 or 3 in. of the tube are then filled without boiling.



Here is a more elaborate barometer than the one shown on the facing page. It has an indicator at the top with a slow-motion screw, the parts being illustrated at the left







A suggestion for making the improved barometer. The scale is moved up and down by a slow-motion screw at the bottom; then the indicator at the top is adjusted with extreme accuracy as in the upper photo

It is not possible, of course, to use the thumb to stop the tube, as the cistern opening is far too narrow. However, a disk of waxed cardboard makes a good substitute. Holding the tube vertically in the crock, lay the disk over the end and clamp it there by turning the cistern bottle upside down over it. Thus sealed, the tube and bottle can be turned right-end up. Still holding the two firmly together, pour a little mercury into the cistern—enough to fill it about ½ in. deep.

At this juncture the assembly should be fixed to the supporting back, which of course must be held firmly upright. Lift tube and bottle together and set them on the shelf between the guards. Slip a strip of soft leather between the tube and each clamp, fold the ends over in front, and screw on the tin strips, leaving them loose enough to allow the tube to be moved. Cautiously raise the tube ⅛ in. to let the mercury assume its level, and tighten the clamps. Keep a *(Continued on page 104)*

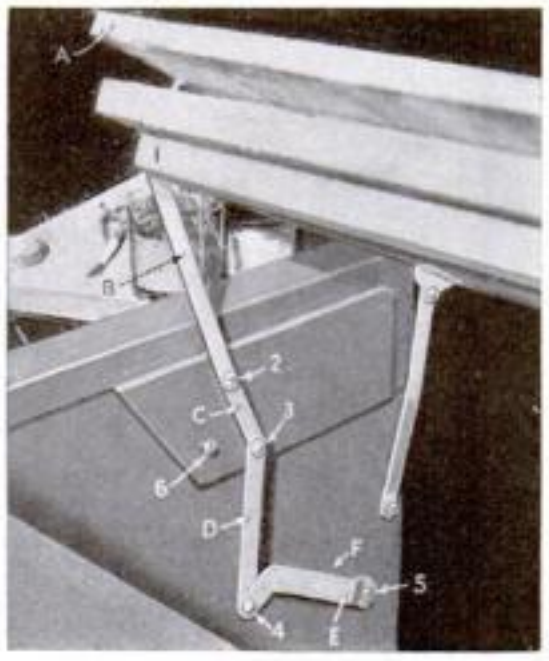
TYPEWRITER DESK BECOMES

Studio Worktable

A stenographer's desk of the disappearing-top type is easily transformed into this practical worktable for an amateur artist or draftsman. The arms that operate the top are merely taken off and put in the reverse of their original position, as shown in the photograph below

A STUDIO worktable sooner or later becomes a necessary part of the equipment of every amateur artist or draftsman. An excellent substitute for high-priced professional worktables can be made from a second-hand disappearing-top stenographer's desk.

The disappearing top *A* is first removed and all metal beneath it detached from the body of the desk. The metal arms *B*, *C*, *D*, *E*, and *F* are then merely reversed. It may also be necessary to cut them down, if too long. They are then screwed and riveted as follows: Arm *B* is screwed into the disappearing top at *1*, and both are attached to the desk body. A thin metal washer should be placed between the desk body and the joint connection of arms *B* and *C* so that they may swing easily when the worktable is in use.

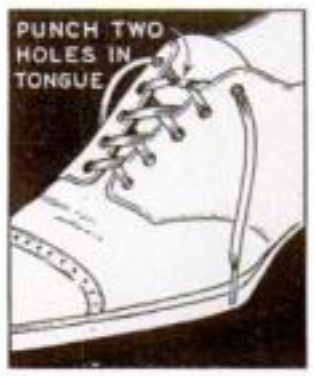


Arm *C* is next connected to arm *D* with a rivet at *3;* arm *D* is similarly riveted to arm *E* at *4*, and arm *E* screwed into the side of the desk at *5* with a metal washer. The same operation is now performed on the other side of the desk. When completed, the top *A* should swing easily and close without slipping. Screw *6* is a stop joint to hold arms *C* and *D* from swinging back too far. Its position depends upon whatever angle is preferred for the slanting top. To open the desk, press down the operating mechanism at point *F* as if it were a pedal.

A hole may be bored in the right-hand side of the worktable for the ink bottle, if ink is used. There is then no danger of upsetting the bottle.

The small tray at the right-hand side of the worktable is made from a ½ by 12 by 18 in. oak board. It may be attached with a hinge or an ordinary clothes-closet swinging arm.—JOSEPH CREAMER.

SHOE TONGUE CAN'T SLIP



IF YOU have difficulty in keeping the tongues of your shoes from side-slipping, you can stop this annoyance by punching two holes, as shown, in the tongue at the point where the laces cross between the upper holes. String the laces through these holes, which will be hidden by the bow.—GEORGE W. KINDER.

Combination Couch and Bed Made From an Old Davenport

A MODERN studio couch that will open into a comfortable bed for two people can be made from an old duofold davenport, three boards, and any suitable covering material. You can obtain an old davenport at almost any used-furniture store. Select one, if possible, of spring construction set in a wood frame. Remove the ends, the back, and all the old imitation leather on the seat. Cut a wide board—¾ in. is thick enough, or you can use old table-top boards—for each end of the davenport, so that it will be even with the front and top of the seat.

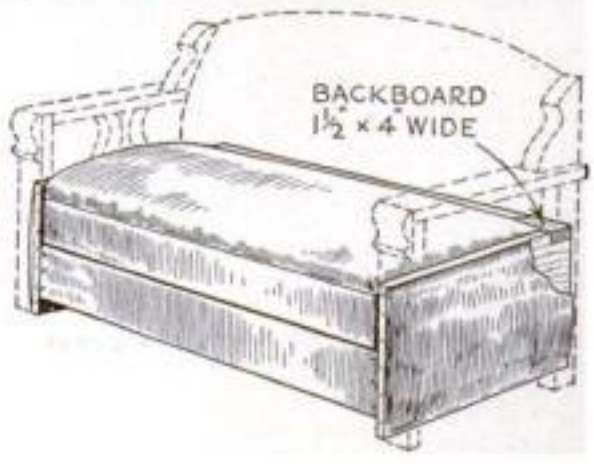
Use the old davenport end as a pattern for marking the bolt holes in the new end. This will insure the davenport's unfolding properly when finished.

Now notch the rear top corners of the davenport ends to receive a board 1½ in. thick and approximately 4 in. wide. This is to be used instead of the old back. It covers an empty space there, helps to brace the ends, and provides a place for a spring latch to hold the seat in its folded position.

Now re-cover the seat. Cover all the way to the bottom on the front; also cover the ends and the backboard with the same material. Take pains to do this evenly and neatly.—CLIFFORD A. LONG.

A comfortable bed for two persons comes out of an attractive studio couch made from an old davenport. The bed is shown at right

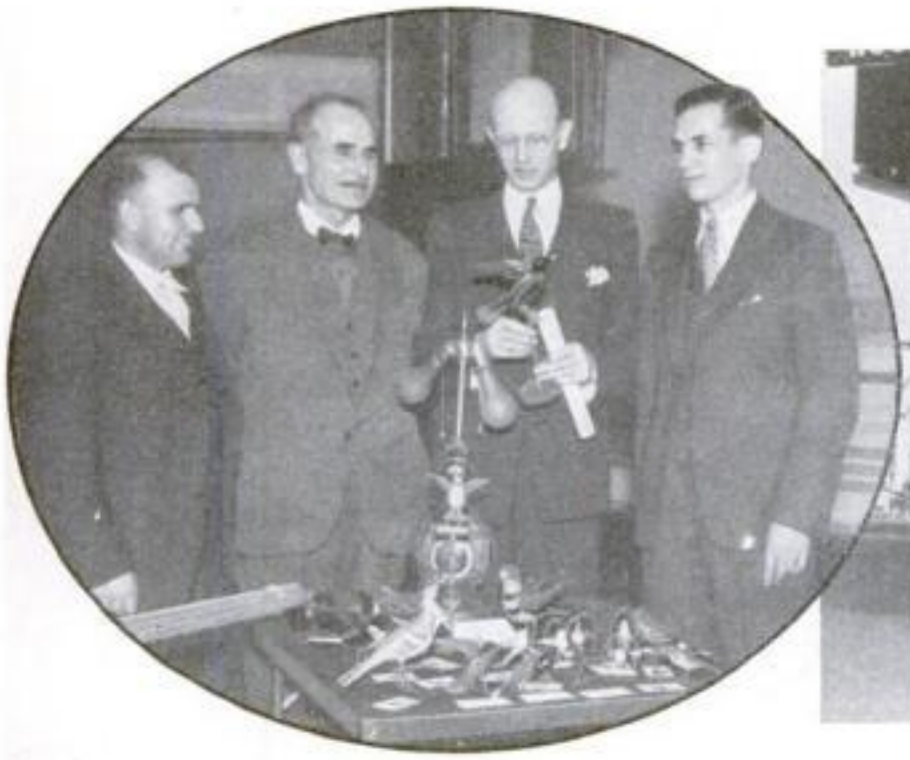
Covered with suitable material, the couch improves the appearance of any room. The drawing shows how the main elements of the davenport are used in constructing couch



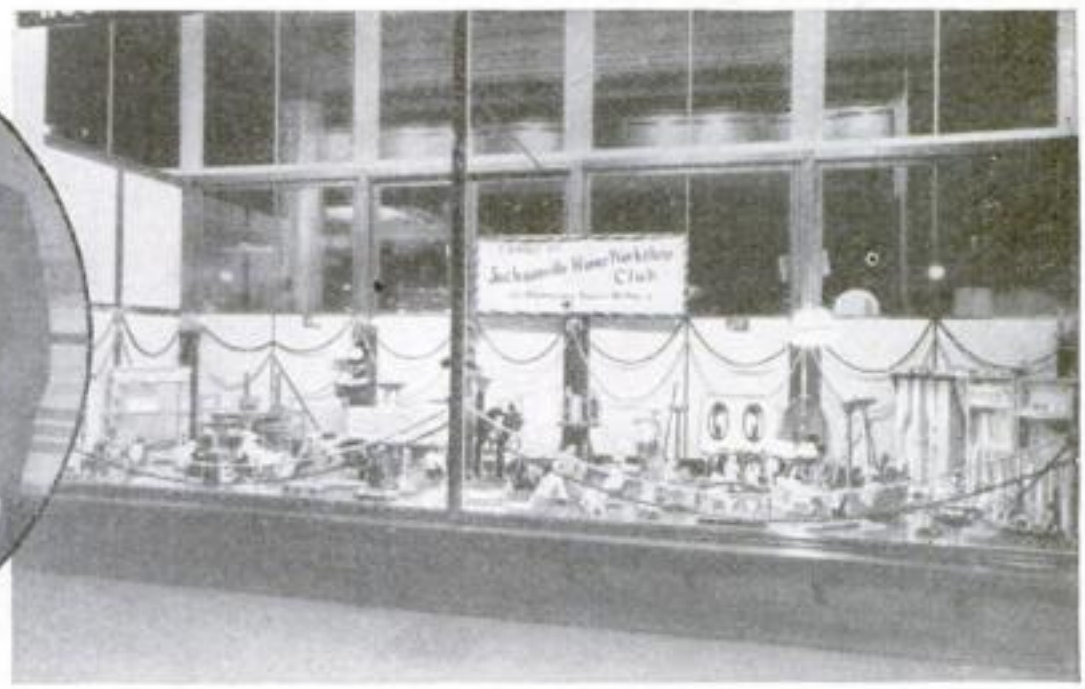
SEE pages 80 and 81 for list of our construction kits.

JUDGES NAMED for GUILD CRAFTWORK CONTEST

RUFUS C. DAWES, LORADO TAFT, and TONY WONS among men who will select winners of trophies and $2,000



Left to right: Joseph Morin, vice president; Peter M. Marsh, wood carver; Earle C. Gilman, president; and Charles C. Gay, secretary, all of Springfield (Mass.) Club



Above: Exhibition of projects built by the Jacksonville (Fla.) Homeworkshop Club for an auction sale. *Left:* Electrically lighted and furnished doll house by George Herman of the Mount Vernon (N. Y.) Club

A store-window exhibition by the Holton (Kans.) Club

PRIZE winners in the first National Handicraft Exhibition and Contest of the National Homeworkshop Guild will be chosen by a distinguished board of judges, the members of which are Rufus C. Dawes, Lorado Taft, Tony Wons, Dr. Herman N. Bundesen, Edward F. Worst, Howard V. O'Brien, Donald A. Price, L. W. Wahlstrom, and Thomas E. Tallmadge.

The judging will be done during the exhibition, which takes place in Chicago, March 25 to 30. The awards will be announced at the Guild's annual dinner. This is to be held in the evening of March 28.

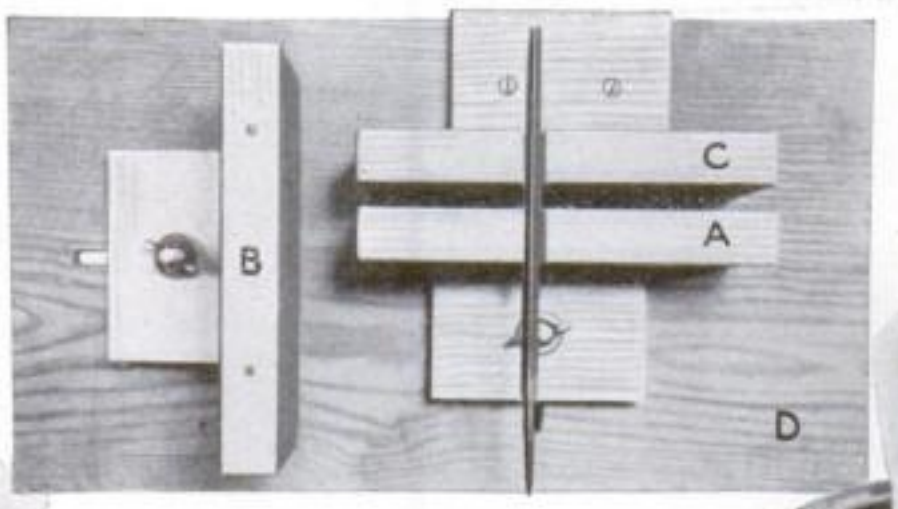
Because of the importance of this first great home workshop show and the value of the prizes—$2,000 in cash and ten cups and trophies—the Guild has selected an entirely independent board of judges. No officer or member of the Guild itself or any representative of the sponsors of the contest will have a voice in deciding the awards.

The work of Mr. Dawes as president of A Century of Progress Exposition is familiar to every reader. He is a business man who has specialized in organizing and managing gas and electric light companies, but he has found time for various public services. He was adviser to the American members of the experts committee that prepared the Dawes plan of reparations *(Continued on page 90)*

Three more silver cups to be awarded at National Exhibition. *Left:* For wood turning. *Center:* For civic activities of clubs. *Right:* The grand sweepstake prize

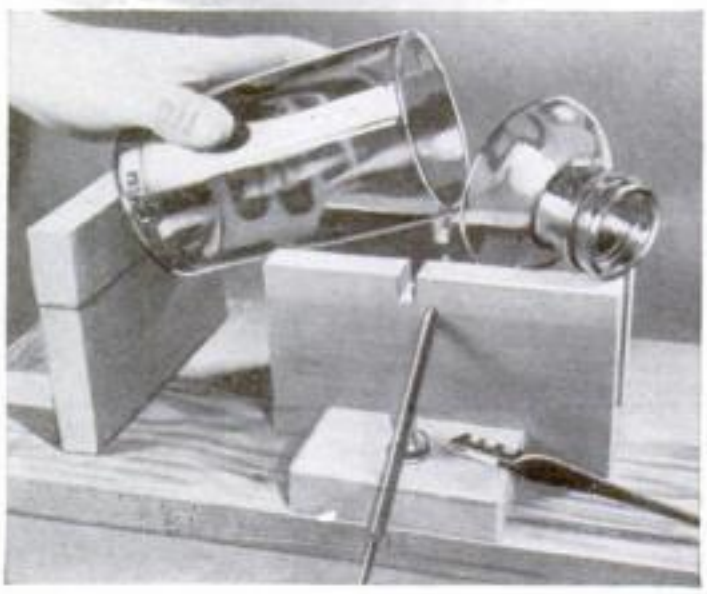
Glass-Cutting Jig

REMOVES TOPS FROM BOTTLES



A top view of the jig with three-cornered file in place across the cradle for cutting a bottle as shown in the photo at the extreme left

How a bottle is rolled on a file is shown above. The position of the cut is fixed by the backstop, which may be adjusted back and forth. A lightweight bottle is cut by rotating it in the cradle in contact with the broken end of a file held as shown at right



The cutting of a heavy bottle is completed by heating it with a string soaked in alcohol and lowering it in cold water

WITH this simple glass-cutting jig, you can remove the tops from bottles in order to make vases, flowerpots, chemical flasks, and any number of other containers.

The wooden base *D* is 8 by 15 in. On it are mounted two uprights *A* and *C*, ¾ by 3½ by 6 in., which form a cradle. The back stop *B* is ¾ by 4½ by 6 in. The small blocks attached to these three parts are about 2¼ by 3½ in. Upright *A* and backstop *B* are adjustable by means of bolts fitted in slots cut in the baseboard.

Slots are provided in *A* and *C* to receive a three-cornered file, and *A* is also drilled at the angle illustrated in another of the photographs to take either a file or a glass cutter.

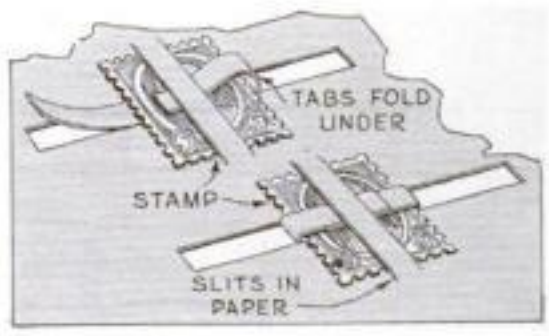
A lightweight bottle can be cut merely by rotating it in the cradle in contact with a file that has been broken off short to provide a sharp edge. For glass tubing, place the uprights close together and use the file lying across them. After this treatment, bottles having thin side walls will snap apart cleanly and evenly with a light tap.

Rather than chance breaking heavier bottles or small square bottles with thick corners, wrap them twice with soft string at the file mark and soak the string with a few drops of alcohol. Light the string and, when the alcohol has burned away, quickly remove the string and slowly lower the bottle, mouth up, in a container of cold water. It will separate into two parts with an audible snap.—KENNETH MURRAY.

SMALL BLOWPIPE MADE FROM OILCAN

A BLOWPIPE is essential in chemical analysis and in testing minerals for fusibility and other reactions. An efficient one can be made from a small five-cent oilcan, a length of rubber tubing, and a valve stem from an old inner tube. Select an oilcan which has a spout with a very small round hole. In one side of the oil reservoir, drill a small hole and solder a section of the valve stem over it to form a connection for the rubber tubing.

The reservoir of the can forms a receptacle for collecting the condensed moisture from the breath, as in the better commercial blowpipes. In addition, the operator's face need not be held near the burner, and no heat from the flame can be accidentally conducted to the lips.—L. C. PELTIER.

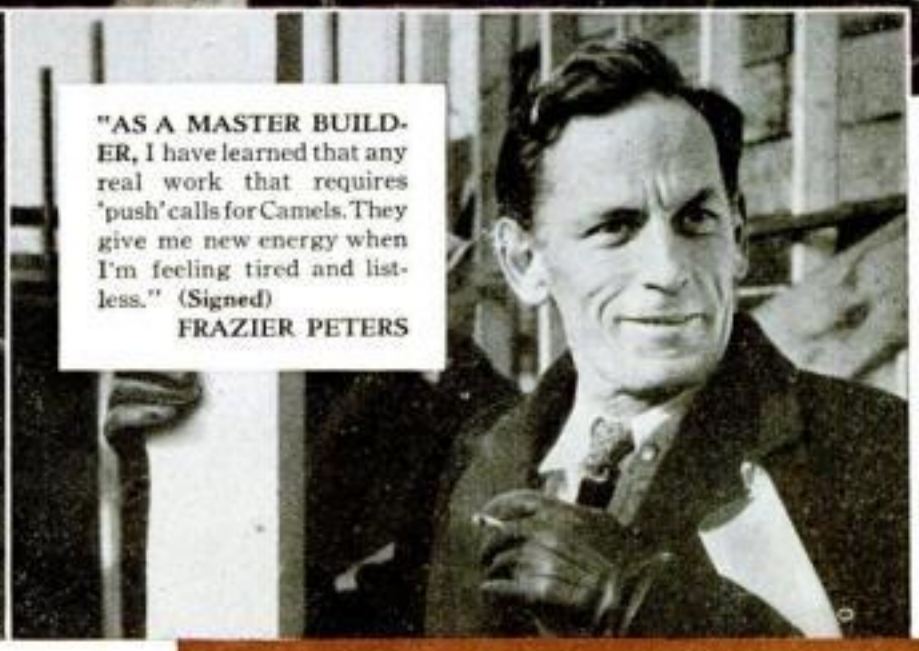


NEAT WAY TO INCLOSE STAMPS WITH LETTER

WHEN inclosing stamps in an envelope, you may attach them safely and neatly to your letter by the method illustrated above. This prevents any possibility of the stamps being lost or removed by some unauthorized person without the knowledge of the recipient.—W. E. LECOUNT.

SPEAKING OF THE EXCITING SPORT with which his name has so long been associated, Ray Stevens says: "When the last heat has been run, it's mighty comforting to light up a Camel. That 'let-down' feeling fades away. I enjoy the pleasure of smoking to the full, knowing that Camels *never* bother my nerves!" (Signed) **RAYMOND F. STEVENS,**
North American Bob-Sled Champion

"I'M A CAMEL SMOKER. Camels restore my 'pep' when I've used up my energy. They taste so good, too. There's nothing like a Camel!" (Signed) **JACK SHEA, Olympic Champion Speed Skater**



"AS A MASTER BUILDER, I have learned that any real work that requires 'push' calls for Camels. They give me new energy when I'm feeling tired and listless." (Signed) **FRAZIER PETERS**

COLLEGE GIRL: "When tired, a Camel makes you feel refreshed." **(Signed) MARGUERITE OSMUN**

LISTEN IN ♫

You'll like the Camel Caravan starring Walter O'Keefe, Annette Hanshaw, Glen Gray's Casa Loma Orchestra over coast-to-coast WABC-Columbia Network.

TUESDAY { 10:00 p.m. E.S.T. / 9:00 p.m. C.S.T. / 8:00 p.m. M.S.T. / 7:00 p.m. P.S.T.

THURSDAY { 9:00 p.m. E.S.T. / 8:00 p.m. C.S.T. / 9:30 p.m. M.S.T. / 8:30 p.m. P.S.T.

MORE EXPENSIVE TOBACCOS IN CAMELS..

"Camels are made from finer, MORE EXPENSIVE TOBACCOS — Turkish and Domestic — than any other popular brand."

(Signed)
R. J. REYNOLDS TOBACCO COMPANY
Winston-Salem, North Carolina

Camel's Costlier Tobaccos never get on your Nerves!

CHECK UP YOUR CLUTCH TO KEEP IT EFFICIENT

(Continued from page 56)

slipped; it couldn't take hold.

"Have you ever driven a car that wouldn't start up without almost jerking your head loose? That's because the clutch takes hold too suddenly. The adjustment may be too tight, the clutch surfaces may be glazed over, or the rivets that hold them in place may be sticking out so that they grab."

"Gosh, isn't there some way to take up for the wear in a clutch without taking it all apart?" asked the car owner as he gazed at the assortment of parts on the bench.

"SURE. On most clutches you can adjust the pedal to make up for normal wear and tear, but *your* clutch is beyond that. The only thing left now is to put on new friction rings.

"Clutches are funny things. The more they slip, the more they wear. From the looks of yours, it's been slipping a long time. If you'd had it adjusted four or five months ago, this might not have happened."

"But how in the world would I know it wasn't working right?"

Gus shrugged his shoulders. "You can't tell how much air is in a tire by looking at it, but you can have it checked at your garage, now and then. Besides, if you know where to look for them, you can find plenty of symptoms of a slipping clutch.

"It generally shows up first in starting; the motor will race, but the car won't move ahead very fast. Then, sometimes, on hills, the engine will suddenly speed up without making the car go any faster.

"You can tell a lot, too, by the feel of the clutch pedal. If you find it doesn't take hold 'til it's almost all the way out, it's usually a sign something's wrong.

"Noises are another warning. When a clutch chatters, chances are the pressure plate is warped or one of the springs is weakening. A squeaking clutch, generally, comes from lack of oil in the throwout bearing, and a rattle means one of the moving parts is loose or a spring is broken.

"Of course," continued Gus, working as he talked. "A slipping clutch doesn't always mean wear or broken parts. Sometimes oil or grease gets on the clutch facings and makes it slip. When that happens, the best cure is a gasoline bath. Turn the motor over slowly and squirt the gas over the disk with a grease gun or an old garden spray."

"But I thought some clutches were supposed to run in oil."

"Some are, but the majority of modern cars use clutches which have to be dry, to work. Except for a few that have more than one friction disk, most clutches are just like yours."

"Gosh!" The car owner wagged his head. "This clutch business is all news to me. I never gave it a thought until today."

"AND that's where most of the trouble comes in," pointed out Gus. "A clutch, to most drivers, is just something you have to fool with every time you shift gears. Most clutch troubles don't come from normal wear; they come from abuse."

"By the way," the man said when Gus announced that the job was finished, "you haven't tipped me off to any tricks I can use to save my clutch."

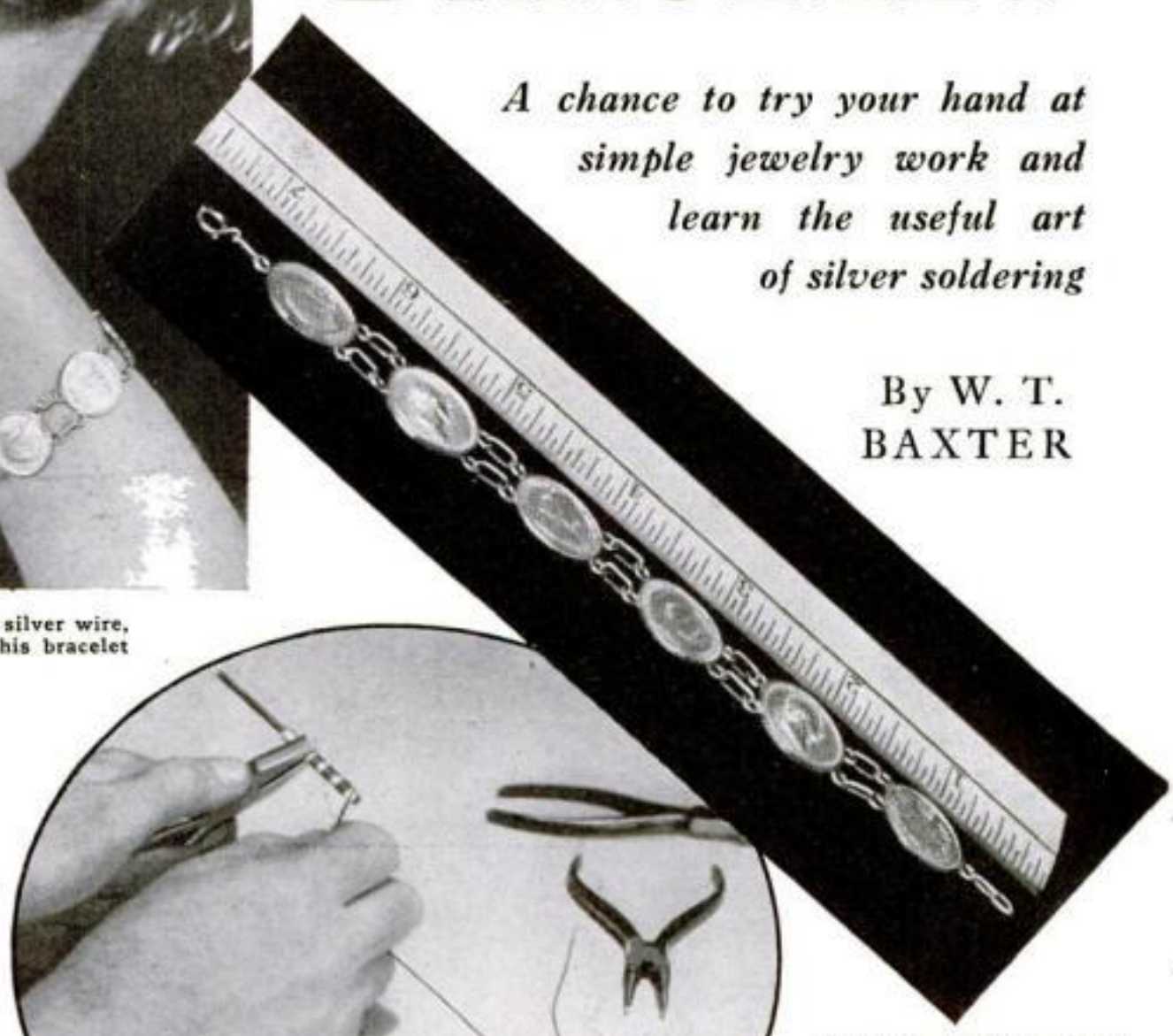
"Forget about the tricks, and use a little common sense," advised Gus. "Just keep your foot off the clutch pedal as much as possible. Don't give the car too much gas when you're starting up. Don't slip the clutch to hold your car when you're stopped on a hill. And let your service man look at the clutch now and then. If a slipping clutch is caught in time, it can be adjusted in a jiffy."

Souvenir Coins *form Novel* BRACELET

A chance to try your hand at simple jewelry work and learn the useful art of silver soldering

By W. T. BAXTER

Six silver coins or medals, a length of No. 20 silver wire, and silver solder are the materials used for this bracelet



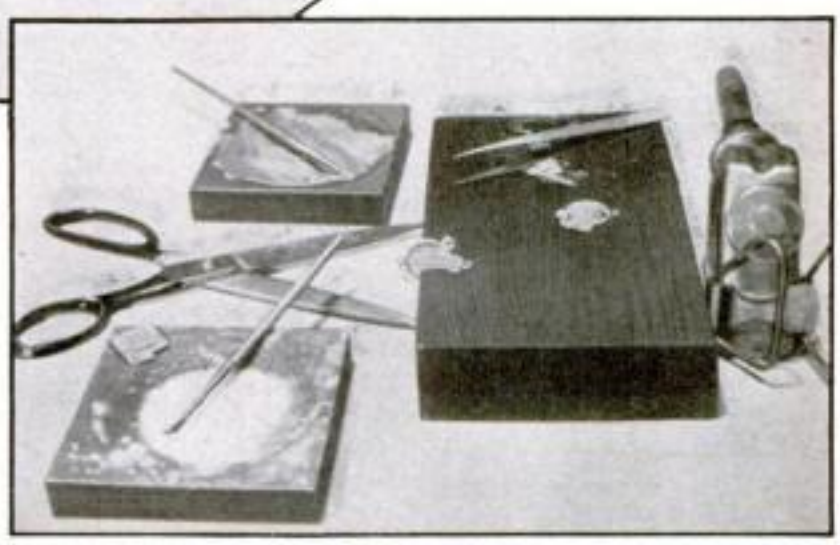
At Left: **Coiling silver wire around mandrels that have been wrapped in paper. The paper is later burned and the coils cut into the necessary rings for the coins**

SOUVENIR coin bracelets form novel and decorative gifts. All that is necessary to make one are six silver coins or medals about the size of a dime, 2 ft. of No. 20 round silver wire, and a piece of silver solder.

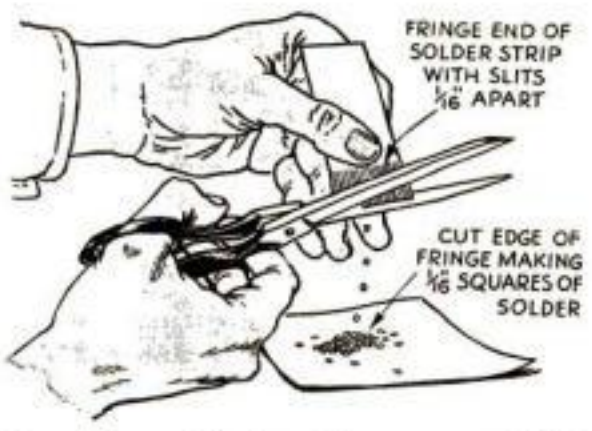
Wrap two thicknesses of newspaper around a small nail. Hold the nail with pliers or in a vise and wrap the wire around it tightly, making about twenty-four turns. Place the nail over a flame until the paper burns, thus allowing the coil to slip off easily. With a pair of end nippers, cut the coil into rings, and use a thin file to make the cut smooth.

By the same process, prepare the connecting links, but use a flat piece of metal about 3/16 in. wide and 1/16 in. thick as a form. Cut this coil into links through the curves.

Lay out the coins or medals in order. The bracelet shown is made of four coins and two George Washington medals. Place them one at a time upon a charcoal block and silver solder the rings on the edges of the coins, as follows: Place joint of ring against coin. The ring will fit better if it is filed flat at point of contact. Cover joint with thin paste of borax and water. With alcohol blowtorch, or blowpipe and Bunsen burner, heat charcoal around ring until moisture in borax is evaporated. With toothpick or small tweezers, place a tiny piece of silver solder in borax solution to clean; then put it on joint to be soldered. Apply flame gently until moisture is evaporated, then heat rapidly until both coin and ring are red hot, at which time solder will flow.



Two coins set in slot in block preparatory to soldering link



How silver solder is cut into very small bits

Silver solder will not bridge a gap easily, so the ring must touch the coin.

After each ring is soldered to a coin, the joint must be covered with a thin paste of yellow ochre (a powder) and water or jewelers' rouge and water, which protects it when the coin is heated again.

The links that hold the coins together are next put in place and hard soldered. A convenient way to hold the coins is to cut a slot in one side of the charcoal block and force the two coins into it, allowing the link to fall upon the block.

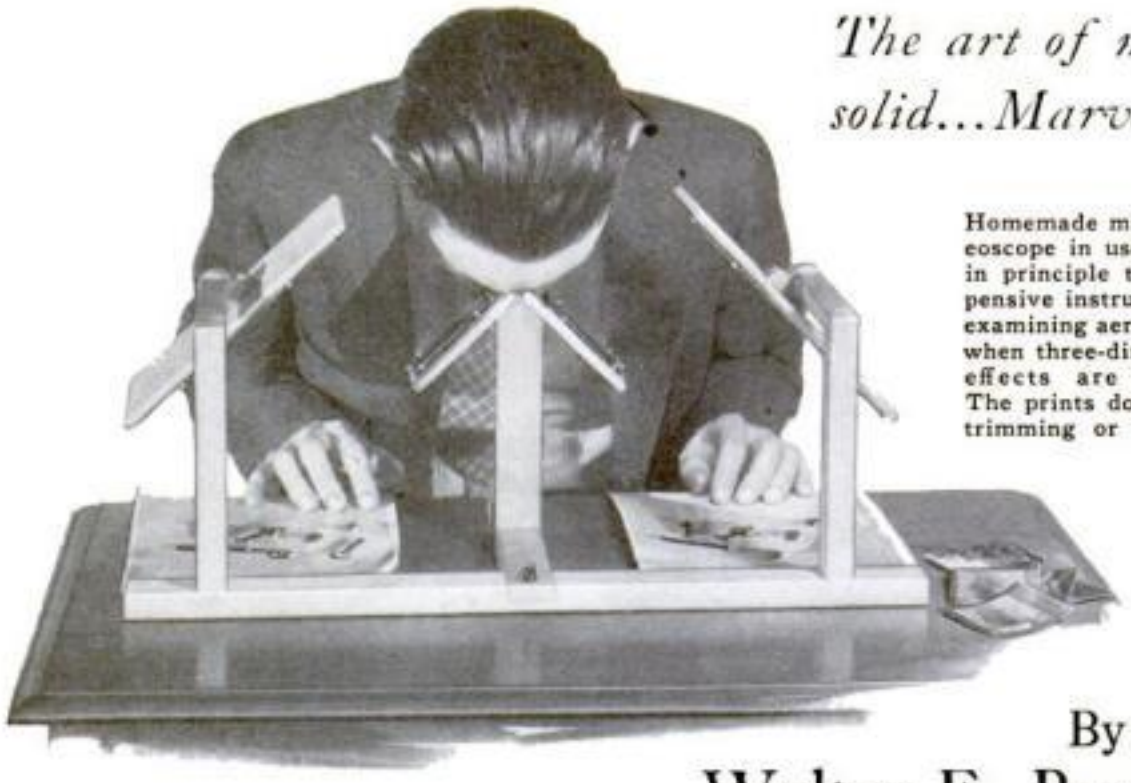
When the coins are linked together, add links at each end until the bracelet is of the required length.

To clean off the melted borax, put the bracelet in diluted sulphuric acid—about fifteen parts water and one part acid—and leave until *(Continued on page 101)*

HOW TO DO MODERN

Stereoscopic Photography

The art of making views stand out as if solid...Marvels of giant and pigmy vision



Homemade mirror stereoscope in use, similar in principle to the expensive instruments for examining aerial photos when three-dimensional effects are desired. The prints do not need trimming or mounting

By Walter E. Burton

IMAGINE that you are a giant, with eyes spaced 20 ft. apart. You could then look at a building 1,000 ft. away and see it stand out solidly in a startling plastic form. Of course, you cannot actually rack your eyes out 10 ft. on either side of your nose, but you can employ a single-lensed camera for photographing the building from two points 20 ft. apart, look through a stereoscope at the prints, and see the building as a giant would see it.

A generation or so ago every living-room table was graced by the family stereoscope, a two-lensed device through which the beauties of Niagara Falls, Chinese temples, and ladies' boudoirs were revealed in three dimensions. The stereoscope in an improved form was revived at the Chicago Century of Progress Exposition last year, and enjoyed considerable popularity.

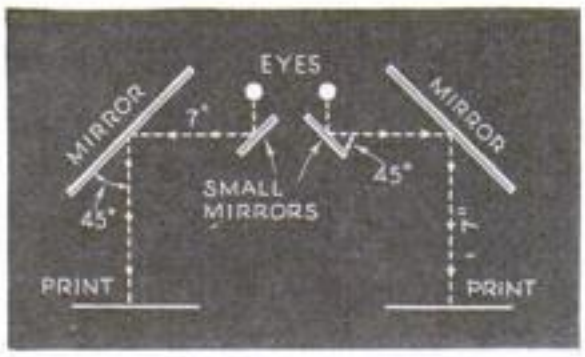
Pictures or stereographs intended for viewing through stereoscopes are made with a camera having matched lenses in twin shutters, spaced about 2½ in. apart. Later, the images are transposed and printed as positives, the transposition being necessary because a camera image is inverted. But such twin-lensed cameras do not tap the real wonders of three-dimensional photography because their lenses are separated the same distance as the human eyes; and the human eyes do not see stereoscopically at distances much greater than 100 ft. or closer than a few inches.

When aerial maps are being made, the camera carried by the plane makes exposures at intervals so arranged that consecutive prints overlap more than half. Any two of these prints will, when viewed through a stereoscope, reveal details in all three dimensions. The buildings of a city thus seen look like tiny, perfect models.

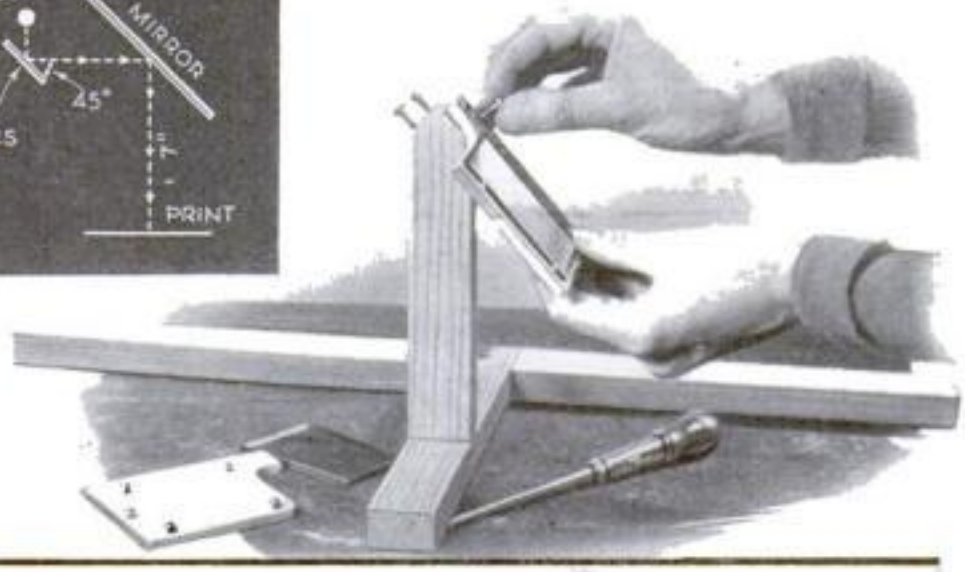
The base line—that is, the line running from one eye point to another—can be increased much farther than these limits in certain cases. Astronomers can photograph a heavenly body just after nightfall and again just before dawn, and get a pair of pictures with a base line about the same as the diameter of the earth; or they can make the pictures half a year apart and obtain a base line running between opposite points of the earth's orbit.

In the same way pigmy vision produces things as they would appear if you were the size of a bee, a gnat, or even a microbe. This is accomplished by making two photographs from points separated only a fraction of an inch, even down to a distance measured in thousandths of an inch, in the case of stereoscopic photomicrographs.

Thus, by making a picture of a tiny insect and then moving the camera ⅛ in. and making *(Continued on page 88)*



Schematic diagram of the stereoscope. *At right:* Attaching the small mirrors to plywood mounts with roundhead screws. The projecting heads hold down the glass

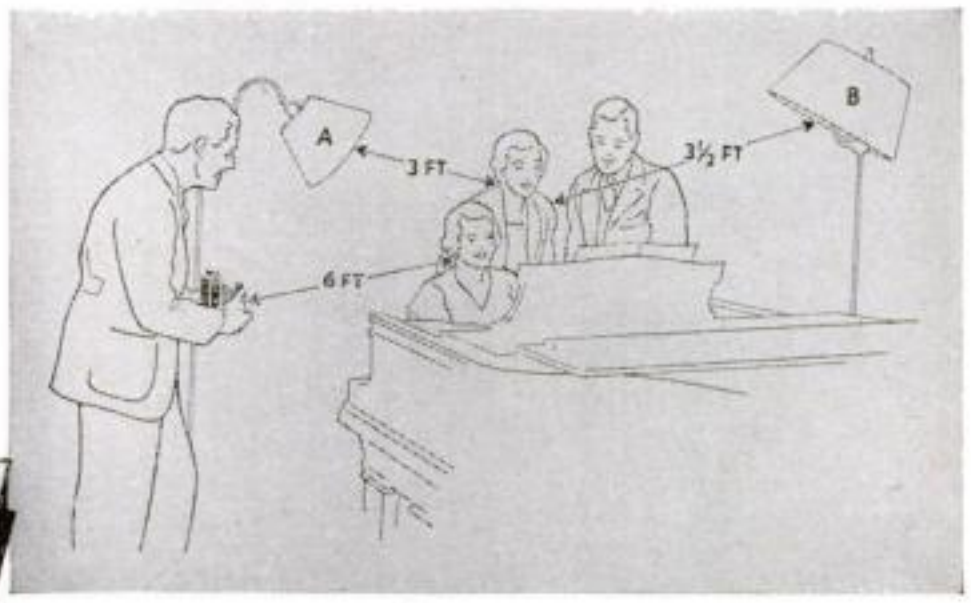


To look at a stereograph without a stereoscope, the observer must move his eyes apart as if he were looking at a distant object, and then bring the pictures in focus without converging the eyes again. This is not a difficult trick. A wedge-shaped prism aids in obtaining this effect

Make this snapshot at home *Tonight*

HERE'S ALL YOU HAVE TO DO

Use Kodak "SS" Film. Set your camera for 1/25 second—open the lens to *f*.6.3. Put 1 Mazda Photoflood bulb in lamp A—2 in lamp B. Distances as indicated. Sight the subject, click the shutter—and you've made the picture.



HOW MANY WONDERFUL PICTURES you've missed because it was dark outside. Now you can get the many things that make evenings so enjoyable—you can take snapshots indoors, at NIGHT.

Just use any camera with an *f*.6.3 (or faster) lens, loaded with Kodak Super Sensitive Panchromatic Film. This high-speed "SS" Film is three times as fast as Verichrome, six times as fast as ordinary film, under artificial light. Two or three Mazda Photoflood bulbs give ample light.

Hold the camera in your hands as you would outdoors, set it for 1/25 second, open the lens to *f*.6.3. Sight the subject, click the shutter. You've made a snapshot. *Indoors . . . at NIGHT.* It's as easy as that.

ALL YOU NEED FOR SNAPSHOTS AT NIGHT

KODAK "SS"—the lightning-fast film, with the green lightning flashes on the familiar yellow box—the film that, indoors or out, in any light, improves picture quality.

MAZDA PHOTOFLOOD BULBS give brilliant light . . . last for about two hours, enough for many pictures. Cost but 25¢.

KODAFLECTOR—Inexpensive, efficient . . . makes 2 Photoflood bulbs do the work of 9. Complete with stand, reflectors and cord, $5.

KODAK RECOMAR "18"

—most versatile of Kodaks. With *f*.4.5 Kodak Anastigmat lens . . . 1/250 second Compur shutter. Double-extension bellows for close-ups . . . long-focus and wide-angle lenses may be used. Ground-glass focusing. Uses cut film, film packs or plates. Ideal for snapshots at night. For 2¼ x3¼ inch pictures—$46.

ONLY EASTMAN MAKES THE KODAK

FREE . . . 32-PAGE BOOK

Here's a book you'll want in your library. Complete details about indoor pictures with Photoflood and Photoflash bulbs. Tells you how to make outdoor night pictures of lightning, lighted buildings, fireworks. How to make moonlight photos. Write to Eastman Kodak Company, Rochester, N. Y.

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P. S. 4-35

Useful Kinks *for* Motorists

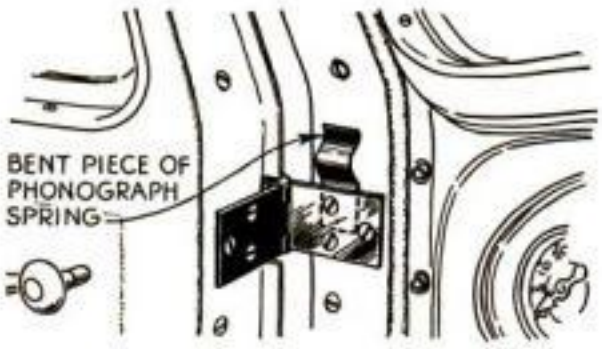
These Suggestions, Contributed by Our Readers, May Save You Time and Money in the Operation of Your Car

With a pair of neat signs to cover the rear doors and windows, any pleasure car may be used for delivery purposes. The signs come off easily when not in use

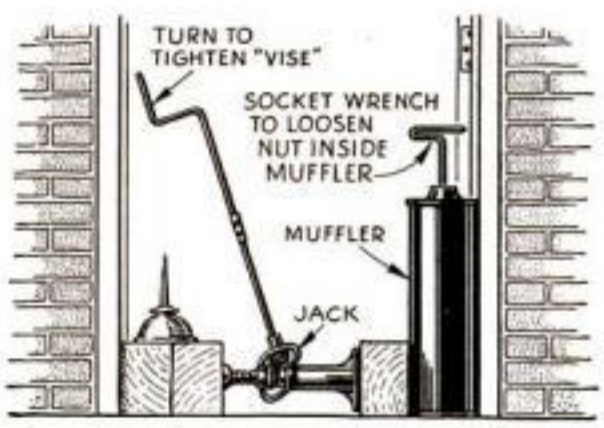
EASILY made snap-on signs will convert any sedan into a trim delivery wagon in less than five minutes. The signs, made to fit over the side windows and doors, can be painted on imitation leather or linoleum. Button fasteners fitted to the car body and the four corners of each sign provide the means of holding the signs in place. When the car is desired for pleasure purposes, the signs can be removed easily.—H. M.

Ends Rattling of Doors

AFTER being annoyed for several months by a rattling door on my coupe I decided something had to be done. When regular commercial anti-rattlers failed I tried a little experimenting on my own. By bending bow-shaped a short length of spring steel taken from the motor of an old wind-up phonograph, and fastening it between the door hinge and the jamb, I eliminated the noise entirely. The spring lasts longer than the usual rubber anti-rattler device.—J. W. C.



A piece of spring steel from the motor of a phonograph stops a door rattle effectively



Improvised Vise

WHILE working on the exhaust system of my car recently, I found that I needed a large vise to hold the muffler while I loosened the nut that held the exhaust pipe. Lacking a vise, I hit on the idea of making use of my jack. Placing the muffler against a door frame, I fitted the jack in between the muffler and the opposite jamb, padding each end with a wood block. A few turns of the handle lengthened the jack enough to hold the muffler firmly in place. The same idea can be applied to many other jobs around a car or in the home workshop where a large vise is needed for a job that a small one cannot handle.—(Miss) M.D.M.

To Stop Radiator Leaks

LEAKY radiators are a common trouble with most cars that have seen several years of hard service. Although several good remedies are available on the market, a can of ordinary aluminum paint provides a cheaper and equally efficient cure. First locate the leak and mark it plainly with a piece of chalk. Then drain the radiator, and apply the aluminum paint to the leaky section with a pipe cleaner, drawing it back and forth through the honeycomb hole or holes until a good layer of paint is deposited. Allow at least an hour for the paint to harden before refilling the radiator.

Aluminum paint, applied with a pipe cleaner, stops a radiator leak at practically no cost

Handy Half Curtains for a Roadster

FOR the roadster owner who is continually getting caught in heavy downpours when his side curtains are stowed away, the homemade half curtains illustrated fill a long felt need. The only tools needed are scissors and an ordinary sewing machine, and the materials consist of about a yard of fourteen-ounce canvas, snaps for the door fastenings, and dot fasteners for the windshield supports. Get the actual dimensions from your own car. Then cut the curtains to the shape shown, allowing sufficient excess on all three sides for folding over and stitching. The buttons and snaps should be placed to agree with those on the car.—C.H.D.

A pair of half curtains like these, easily made from light canvas, are handy to have along when caught in a sudden rain

Touch-up Paint

IN TOUCHING up worn spots in body and fender finishes, apply the paint with a small brush and thin the fat outer edge with a circular motion of the thumb. This eliminates any overlapping effect—R. S.

Brightens Spare Tires

OLD SPARE TIRES as well as car tops can be made presentable by applying ordinary black liquid shoe polish with a brush or dauber. Incidentally, a bottle of shoe dye or polish also is a handy thing to have around when repairing leather upholstery; it will color worn spots and cover stains.—R. L. S.

SCIENCE INSURES *Ford Accuracy*

PISTON PINS MAY BE LITTLE THINGS — BUT LOOK HOW THEY'RE INSPECTED

MODERN science plays an important part in these ingenious automatic machines built by the Ford Motor Company to inspect piston pins. Radio principles are employed and a photo-electric cell or electric eye indicates the hardness.

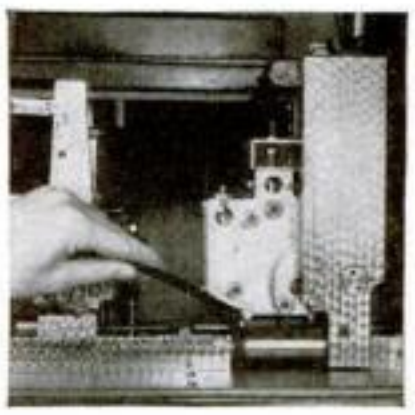
The machine checks every piston pin for smoothness, hardness, straightness, roundness and diameter. One machine can check over 1500 pins an hour and those not up to the high Ford standard are automatically rejected.

First the pins are forced through a unit that wipes the surface clean. Then they slide under a needle on a pick-up head. Microscopic variations in surface finish set up vibrations which are amplified by a two-stage radio amplifier, and unless the pin is absolutely smooth the machine rejects it.

Next an automatic scleroscope checks the hardness. A light beam passes through an opening at the correct scale reading onto a photo-electric cell. The scleroscope hammer is released, strikes the pin, and rebounds to indicate hardness. If the pin has the right hardness the hammer rebounds and intercepts the light beam for a sufficient interval. This sets the mechanism to okeh the pin. If pin is not hard enough the hammer does not rebound high enough to intercept the beam; if the pin is too hard the hammer goes past the opening. In both cases the mechanism rejects the pin.

The next two units of this machine inspect for straightness and roundness. A variation of only one ten-thousandth of an inch — 1/30th the thickness of the average human hair — throws the pin out. That's accuracy for you!

The last unit measures the diameter and sorts the pins according to size. Pins distributed in the three center trays have passed inspection and are graded by one ten-thousandth of an inch. The tray on one end receives all oversize pins. The other end tray receives all undersize pins—these are scrapped.



When such machines are used for the inspection of parts there can be no compromise with accuracy. This is just one example of the painstaking efforts of the Ford Motor Company to make sure that Ford parts are right. It is one reason why it is possible to maintain such high standards of quality in Ford cars and yet sell them at such low prices. It is also a reason why Genuine Ford Parts are the best parts you can use in your Ford car or truck.

GENUINE Ford PARTS

FORD MOTOR COMPANY, DEARBORN, MICHIGAN

DONALD W. CLARK designs a new simplified model of a

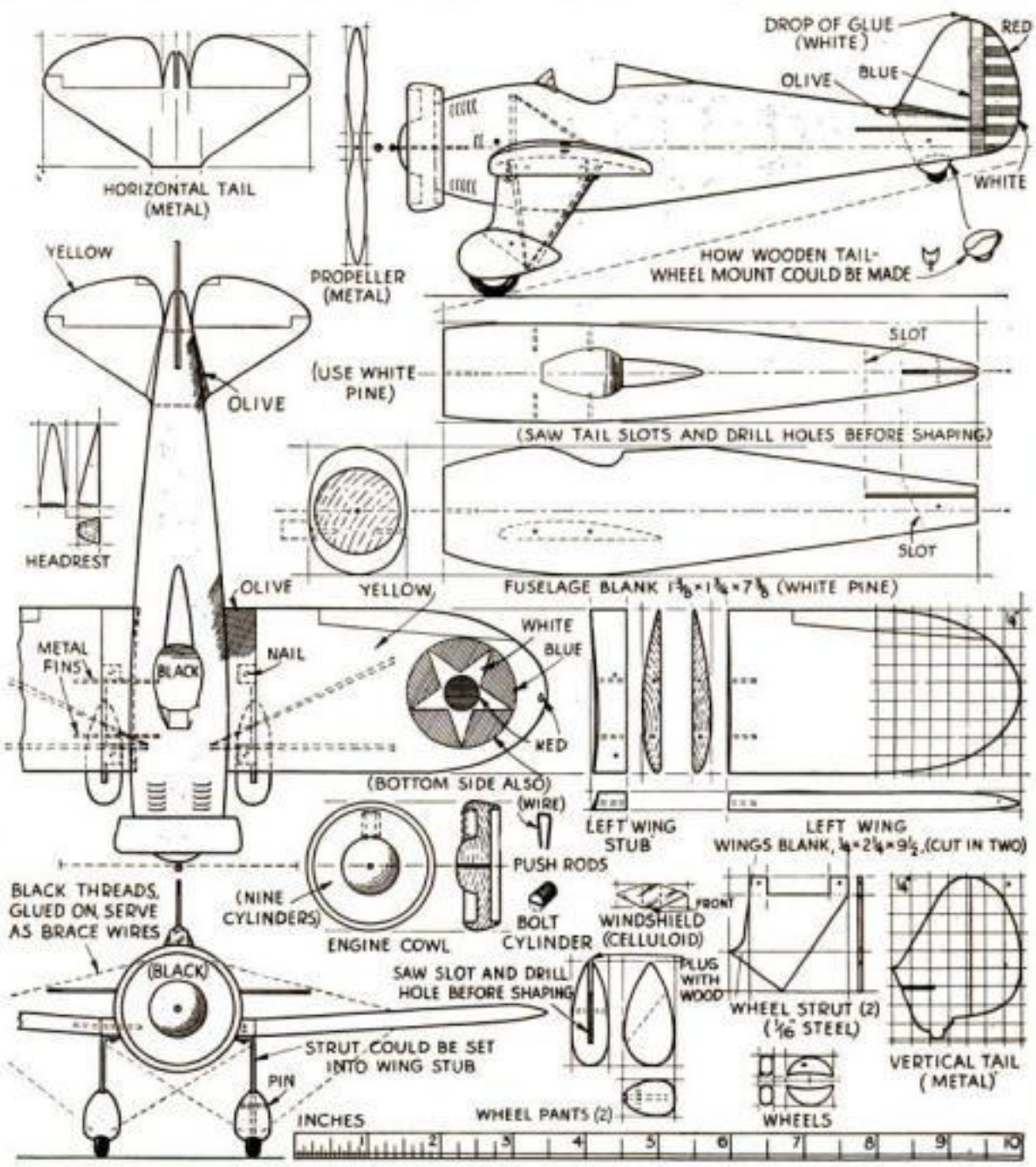
Fast Army Pursuit Plane

ONE of the world's fastest high-altitude combat planes is the trim little Boeing P-26 A. It is an all-metal, low-wing monoplane built especially for the United States Army. A supercharged 600-H.P. Wasp engine drives it at a speed of more than 200 miles an hour. The span of this fast ship is only 27 ft.

This simplified model is built on a scale of ⅜ in. equals 1 ft. of the real airplane. Only seventeen parts are required, not counting the engine cylinders, which are short sections of bolts cemented to the recess in the cowling as shown. The push rods may be made of wire, set into the crankcase and cemented to the cylinders. With sharp tools and a little patience, the cowling may be shaped by hand from balsa or white pine if a lathe is not available.

It is best to fit the wing stubs to the fuselage before sawing them off the wings, as it is then easier to hold them. The holes for the wing pins also should be drilled before cutting off the stubs so that the wings will fit exactly.

A coat of flat white paint will serve as a filler and form a good base for the other col-



Top, front, and side views of the new Boeing pursuit plane, and details of the fuselage, engine cowl, wings, wing stubs, tail units, wheels and "pants," wheel struts, propeller, and other parts

The wing pins should be bent slightly upward to give the necessary dihedral to the wings

ors, but use a good grade of paint. Some model makers prefer to apply a coat of clear nitrate "dope" for this purpose. Mark the insignia and other details with a hard lead pencil before painting. The colors are: fuselage, wing stubs, wheel struts and wheel "pants," olive; wings, horizontal tail, and vertical fin, yellow; engine, tires, and trim, black; propeller and wheel disks, aluminum; insignia, red, white, and blue. Black writing ink may be used to get the dull effect of tires, cockpit opening, and recesses in the cowling.

Realistic as the model is when finished, it requires only these seventeen simple parts

Gluing the headrest to the fuselage. The wheels also are attached with glue or cement

HOW TO TEST THREADING QUALITY OF PIPE

Too often the selection of pipe for a given service fails to take into account its threading characteristics. However, if the threading equipment is in reasonably good condition, the problem of poor threads usually can be traced back to the material. It is an excellent precaution to test all pipe, the quality of which has not been well established. The simplest and most effective test may be made with nitric acid, after filing and cleaning a bright spot on the pipe.

The application of nitric acid will leave a dark spot on steel pipe. The darker the spot, the harder will be the steel and the more difficult to thread. The bright spot on wrought-iron pipe will remain bright after being touched with nitric acid. In most cases, when threads are persistently leaky and it is difficult to find the source of the trouble, the acid test will clear it up.—HARRY KAUFFMAN.

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Will Help You *spend time profitably* . . .

Building your own
LOG CABIN

OUR Blueprint No. 134-R, price 50 cents, contains plans, list of materials, and building suggestions for a three-room log cabin designed by William G. Dorr, A. I. A. The over-all width, including a large porch, is 37 ft., and the over-all depth, 20 ft. The drawings show frame construction with log siding or similar material nailed on to give the effect of real logs. There are also sketches showing how to use real logs. Other designs and further information on this general subject are contained in our new $2 book *How to Build Cabins, Lodges, Bungalows.*

NO MATTER how much or little time you have for your home workshop activities, it pays to concentrate your efforts on worth-while projects. To help you do this, we offer a series of blueprints for models, furniture, radio sets, toys, and other projects. The following list gives a wide selection, but many other prints are available. Send a stamped and addressed envelope for a complete list.

Our blueprints are each 15 by 22 in. and cost 25 cents a sheet (except in a few special cases). Order by number. The numbers are given in italic type and follow the titles. When two or more numbers follow one title, it means that there are two or more blueprints in the complete set. If the letter "R" follows a number, it indicates that the blueprint or set of blueprints is accompanied by photographically illustrated instructions which supplement the drawings. If you do not wish this supplement, omit the letter "R" from your order and deduct 25 cents from the price given. Instructions alone are 25 cents each.

RADIO SETS

All-Wave Portable (battery), *217-R*	.50
Amateur Short Wave Receiver, *155*	.25
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Amplifier, Three-Stage Audio-Frequency, *42*	.25
Five-Tube Short Wave (A.C. or D.C.) *223*	.25
Full Electric Headphone Set, *130*	.25
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Screen-Grid Set, *109*	.25
Short-Wave Converter Unit, *137*	.25

BOATS

*Canoe, 16-ft. Canvas Covered Kayak, with sail, etc., *192-193-194-R*	1.00
*Duck Boat, Folding, *170-R*	.50
*Outboard Racer, 10½-ft., 114 lb., *211-212-R*	.75
*Sailboat-Motorboat, Combination (15 ft., cat rig), *131-132-133-R*	1.00
Marconi Rig with Jib for Above, *133-A*	.25
*15½-ft. Runabout or "Sportboat" (outboard or inboard motor), *175-176-177-R*	1.00
*13-ft. Utility Rowboat (can be sailed or used with outboard motor), *224-R*	.50

NOTE: Full-size patterns for any boat marked with an asterisk (*) will be drawn to order for $1.50 extra. Simply add this amount to the cost of the blueprints. About one week is required to fill orders for patterns.

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Bench and Tilt-top Table, Combination, *11*	.25
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Floor Lamp with Tripod Base, *243A*	.25
Magazine Rack, Ladder-Back Style, *250A*	.25
Mirror Frame with Split Turnings, *246A*	.25
Pier Cabinet and Hanging Shelves, *77*	.25
Lamps, Modern (no turning), *93*	.25
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Smoking Cabinet (no turning), *2*	.25
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Bremen (Junkers, 3-ft), *89-90*	.50
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S. E. 5a World War Plane, 30-in., *168-169*	.50
Winnie Mae, 4-ft., *141-142-143*	.75

SHIP AND COACH MODELS

{Construction kits are available for some of these models. See page 80.}

Aircraft Carrier—U.S.S. Saratoga (18-in.) and flush deck destroyer (6¼-in.), *226-227-R*	.75
Battleship—U. S. S. *Texas* (3-ft. hull), *197-198-199-200*	1.00
Bottle, Clipper Ship in, *121-122*	.50
Clipper Ship (20¼-in. hull), *51-52-53-R*	1.00
Clipper, Simplified (9½-in. hull), *219*	.25
Constitution (21-in. hull), *57-58-59-R*	1.00
Cruiser *Brooklyn* (8-in.), *236*	.25
Cruiser *Tuscaloosa* (11¾-in.), *234*	.25
Destroyer—U. S. S. *Preston* (31½-in. hull), *125-126-127-R*	1.00
Galleon *Revenge* (25-in.), *206-207-208-209*	1.00
Hartford, Farragut's Flagship (33½-in. hull), special prints *221-222-R*	1.50
H. M. S. *Bounty* (8½-in. hull), *254*	.25
Mayflower (17½-in. hull), *83-84-85-R*	1.00
Motorboat, 29-in. Cruiser, *63-64-R*	.75
Motorboat, Working Model (20-in.), *196*	.25
Liner—*Aquitania* (9-in.), *225*	.25
Liner—*California* (12½-in.), *251*	.25
Liner—*Manhattan* (12-in. long), *204*	.25
Liner—*St. Louis* (11-in.), *231*	.25
Privateer of 1812—*Swallow*, a Baltimore clipper (13-in. hull), *228-229-230-R*	1.00
Santa Maria (18-in. hull), *74-75-76-R*	1.00
Stagecoach with horses, *144-145-146-R*	1.00
Steamboat, *Mississippi* (19½-in.), *94-95-96-R*	1.00
Steamships *Savannah* (3 in. over all) and *Atlantic* (6 in.), *235*	.25
Trading Schooner (17½-in. hull), *252-253*	.50
"Treasure Island" Ship *Hispaniola* (7-in.), *237*	.25
Viking Ship, (20½-in.), *61-62-R*	.75
Whaler—*Wanderer* (20½-in.), *151 to 154*	1.00
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Yacht *Sea Scout* (42-in. racing), *106-107-R*	.75
Yacht, (20-in. racing), *48-R*	.50

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Arbor with Garden Gate and Seats, *9*	.25
Automatic Lighthouse Night Lamp and Pelican Design Sewing Kit, *255A*	.25
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Doll's House, Colonial, *72*	.25
Doll's House Furniture, *73*	.25
Log Cabin, Three-Room, *134-R*	.50
Microscope Kit, Portable, *220*	.25
Six Simple Block Puzzles, *65*	.25
Star Chart, Perpetual, *214*	.25
Toy Birds and Animals, Jig-Sawed, *56*	.25
Toy Drill Press, Lathe, Saw, etc., *113*	.25
Toy Dump Truck, Fire Engine, etc., *101*	.25

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Old Bill SAYS:

WHEN boring heavy work of irregular shape in the lathe, it pays to spend sufficient time to balance the faceplate properly. The concentricity of the bore depends on this precaution.

• • •

Forget everything but your machine while at work. That will also help the other fellow to do the same. Carelessness and inattention are what cause most shop accidents.

• • •

Modern lapping compounds cut quicker than the scraper for many fitting jobs.

• • •

It is every mechanic's duty to study the amount of shrinkage on a piece of tool steel so as not to make the mistake of allowing too much stock for grinding previous to heat treating. The question of warping should also be taken into consideration.

• • •

A defective ram on a punch press can quickly "wing" an expensive punch-and-die job.

• • •

A toolmaker who takes pride in being accurate, keeps his square in a special case and has it tested at least once a year.

• • •

When using a hardened mandrel or arbor on the lathe for shoulder work where extreme accuracy is necessary and where the arbor is reversed to maintain a given width, it is important to eliminate any variation due to the wear of the center. This can be done by using a ball-bearing live center.

• • •

A hardness depth of from .040 to .060 in. can be had on mild steel by carbonizing, reheating, and cyaniding. This method will give the parts a clean gray finish.

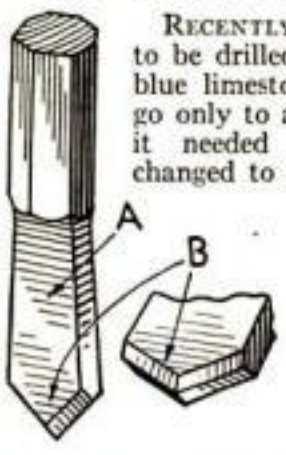
• • •

When filing aluminum, apply a little paraffin to the file.

• • •

If a grinding wheel appears too soft, increase its speed; if it appears too hard, decrease it. This rule is applicable to small shops with limited equipment.

FLAT DRILL CUTS HOLES IN VERY HARD STONE



RECENTLY a number of holes had to be drilled by hand in very hard blue limestone. A star drill would go only to a depth of ¼ in. before it needed redressing. We then changed to a drill forged as shown in the shape of an old-fashioned flat or "farmer's" drill, but used like a star drill. The results were surprisingly good. This type of drill will work equally well in softer substances.—F. W.

Paper Veneer Covers Costly Looking

FIRESIDE SCREEN

INLAYING is considered a difficult craft, but anyone can imitate it successfully by using what is known as "wood-veneer paper." This is reasonably durable when mounted and shellacked, and to the uninitiated the finished inlay cannot be told from the conventional wood type. The fireside screen illustrated is covered with it.

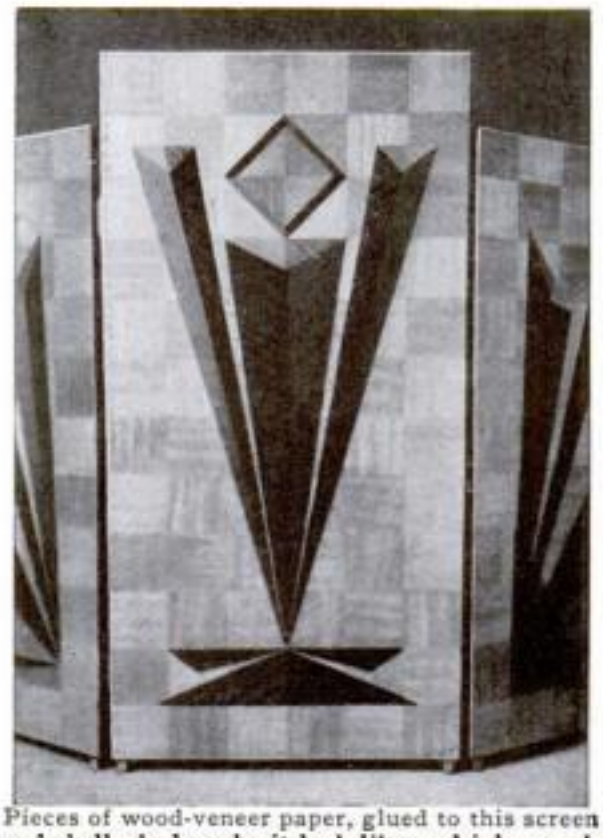
The paper can be obtained in art stores and from dealers. That used by the author cost 20 cents a sheet, 20 by 30 in. The only tools necessary are a cutting board, straightedge, single-edged razor blade, small glue brush, and a bottle of liquid glue.

The screen is made of ⅜-in. plywood as shown in the drawing. The back is lacquered green, and the edges painted gold or silver.

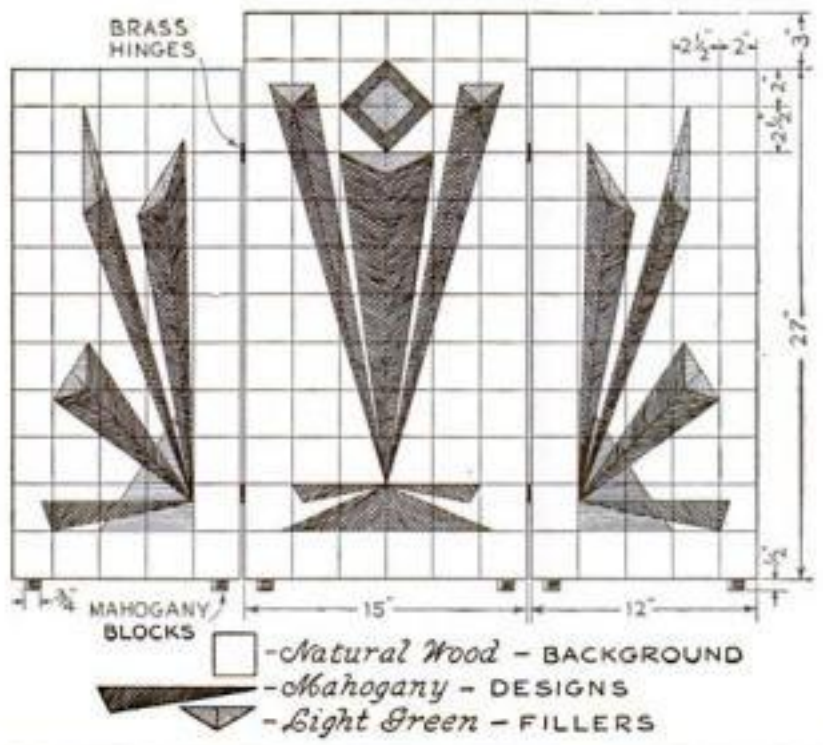
In this case the veneer-paper design is mahogany with green fillers, and the background, which is applied last, consists of natural wood squares with their grain run alternately at right angles. The squares are 2½ by 2½ in. except along the upper and outer edges of the wing pieces, where they are slightly smaller. Any design may, of course, be used.

First mark the design on the plywood. Next, select the desired color and mark the correct shape of each piece on the sheet with a very sharp pencil. Do not try to cut out all the parts and then put them together, but do one at a time and fit the next or adjoining part to that already mounted. Give the completed screen several coats of shellac put on with a spray gun, if available. Be sure the surfaces are laid flat to avoid any running of the color. Sand lightly between coats.

Standard colors that may be obtained are green, red, gray, light green, yellow, and natural. Other colors may be made by staining the natural as desired. Card-table tops, all types of screens, beds, paneled furniture, and even the interior walls and doors of a house offer excellent subjects.—LESLIE M. HOLBROOK.



Pieces of wood-veneer paper, glued to this screen and shellacked, make it look like real inlay work



Auto Racing Improves Passenger Cars

(Continued from page 21)

speed, and all the racing drivers used gasoline from that particular well. Tetraethyl lead made its appearance in 1924, and, since then, lead-treated gasoline has been used by the winner of every Indianapolis race, and every other important race. From the speedways and the dirt tracks its use has spread to the motoring public.

Even a slight increase in the efficiency of an automobile part at sustained high operating speeds becomes a great improvement under the much less trying conditions of ordinary business or pleasure driving. If an improved part shows an increase in efficiency of even one percent at 110 miles per hour, its efficiency will be increased forty or fifty percent at normal driving speeds.

In the early years of racing, even the best cars broke down in more races than they finished. But every breakdown taught the engineers and manufacturers a lesson, and many of those mishaps resulted in advances in the efficiency of the production automobile.

Twenty-five years ago many serious motoring accidents were caused by broken steering knuckles. The same failure caused smashups on race courses. Experience gained in racing showed that steering knuckles broke because they had become crystallized by the vibrations set up at high speed. Changes were made in design and materials, and now a broken steering knuckle is hardly ever heard of in either racing or ordinary driving.

STEERING wheels used to break. Bob Burman, attempting a sharp turn at high speed in one of the old road races, pulled the wood rim of his steering wheel right off the spider. Bob crashed, but ever since then, steering-wheel rims have been made so that they can't come off, no matter how hard you twist them.

Frames used to buckle and axles used to break under racing stresses. We should thank the race drivers for the sturdy frames and safe axles of today's cars.

Early automobile springs were modeled after the springs of horse-drawn vehicles. Those long, curved springs were all right for slow road driving, but they were much too resilient for racing. So the race drivers used to tape them to take out some of the bounce, and from this practice developed the shorter, flatter, and more efficient springs of to-day.

Shock absorbers were first used on racing cars. So were magnetos. And so were superchargers, which recently have been adapted to a few passenger cars.

Only a few years ago, cleaning spark plugs was a once-a-week job for careful motorists. Racing experience led to the development of the modern plugs that demand practically no attention.

Another of the lessons that automobile manufacturers learned from racing is that pressure lubrication of every single engine bearing is necessary. And in the design of bearings, racing practice—the use of thin babbitt and the steel-backed bearing—has been incorporated in standard production.

In the early days of racing, it was the duty of the mechanic riding with the driver to lean far out from the side of a racer rounding a curve to keep the car from turning over. As speed increased, this job became too much for the mechanics, and designers began to pay more attention to balance. When Ray Harroun, himself an able engineer, won the first Indianapolis "500" in 1911, the ability of his Marmon Wasp to hold the turns easily at seventy-five miles an hour attracted the attention of all automobile designers. They found that proper weight distribution was the secret of that ability, and as a result achieved a degree of balance in passenger cars that makes it possible for the ordinary motorist to drive his car around turns at brisk road speed without even a thought of turning over.

QUITE as important as the problem of proper car balance was the problem of balance in rotating parts. Racing drivers spend many hours delicately balancing their wheels with small lead washers, because a deviation from balance of one ounce in an automobile wheel running at 100 miles an hour exerts a centrifugal force of 500 pounds, which is sufficient to lift the wheel and axle from the track when the heavy side comes up. Imagine the effect of even a slight lack of balance in a crankshaft turning 6,000 revolutions per minute! The development of perfectly balanced crankshafts, which avert the vibration that used to wreck vital engine parts, is the direct result of racing experience.

Automobiles used to be much more expensive than they are now. One reason was that they had to use engines of large capacity and slow speed, engines that ranged from 300 to 800 cubic inches piston displacement and made about 1,000 revolutions a minute. These big, heavy engines were difficult to balance, and cars had a dangerous habit of getting out of control when the roads were the least bit slippery. It was obvious that if the automobile was to (Continued on page 112)

GET OUR NEW LOW-PRICED KIT FOR A MODEL OF H.M.S. *Bounty*

KIT Z—Model of H.M.S. *Bounty*

KIT O—An 11-in. model of the S. S. *St. Louis*

S. S. *Atlantic*

KIT S

S. S. *Savannah*

Three famous ships. The two small ones are in one kit

THE mutiny on the *Bounty* took place a century and a half ago, but the ship is probably more famous today than she ever was. For that reason she has been selected as the Popular Science Model-of-the-Month Club project for April. She makes one of the most beautiful small ship models in the entire series and is well worth building entirely aside from the romantic glamour that surrounds her history.

A complete construction kit for building this new miniature model of the *Bounty* has been prepared especially for Model-of-the-Month Club members. The price is $1.50, postpaid anywhere in the United States. Readers who are not members of the club may obtain the kit for the same price while the supply lasts, and they will find in each kit an application card for joining the club, if they wish to avail themselves of the opportunity.

The kit contains a soft pine hull block carefully cut to the correct profiles, all necessary wood, rigging cord, fiber, wire, beads, glue, finishes, and miscellaneous materials, and a full-size blueprint. The finished model has a hull 8½ in. long, is 11½ in. long over all, and stands 8¼ in. high. The hull block is designed for making the complete hull, but if you prefer a water-line model, like all previous models in the Model-of-the-Month Club series, the block may be cut off on the water line, thus reducing the height of the model to 7 in. The scale of the model in relation to the full-size ship is 1/12 in. equals 1 ft.

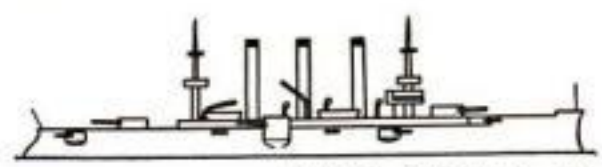
The new kit is marked Z in the following list, which gives all our construction kits. Those listed as "standard ship model kits" are for our larger and more elaborate models, all of which were designed by Capt. E. Armitage McCann. He also built the new *Bounty* model, it being one of the few miniature models he has made. That in itself is enough to guarantee its beauty, accuracy, and authenticity.

KIT U—*Hispaniola* of "Treasure Island"

KIT X—A 12½-in. model of S.S. *California*

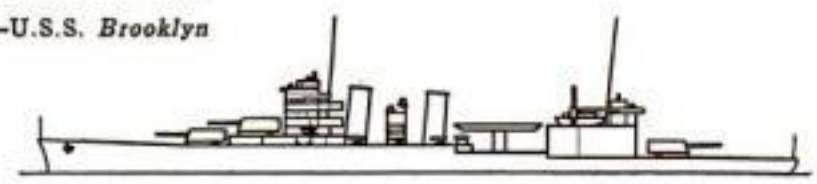
STANDARD SHIP MODEL KITS

A.	Whaling Ship *Wanderer*, 20½-in.	$6.90*
AA.	Same with hull lifts sawed	7.40*
D.	Spanish galleon, 24-in.	6.45*
DD.	Same with hull blocks shaped	6.95*
E.	Battleship U.S.S. *Texas*, 3-ft.	6.95*
EE.	Same with hull lifts sawed	7.45*
G.	Elizabethan galleon *Revenge*, 25-in.	6.75*
GG.	Same with hull blocks shaped	7.25*
L.	Farragut's flagship *Hartford*, a steam-and-sail sloop-of-war, 33½-in. hull	7.95*
LL.	Same with hull lifts sawed	8.45*
Q.	Privateer *Swallow*, 12½-in. hull with	

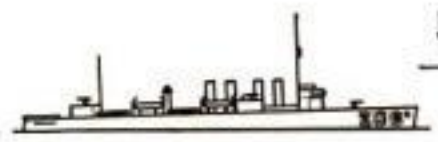


KIT T—U.S.S. *Brooklyn*

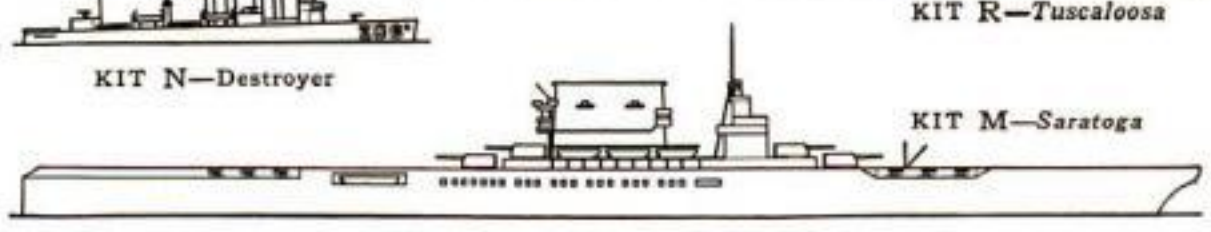
Here is a remarkable fleet of outstanding American fighting ships, all built to the scale of 1 in. equals 50 ft. The model of the aircraft carrier *Saratoga* is 18 in. long



KIT R—*Tuscaloosa*



KIT N—Destroyer



KIT M—*Saratoga*

KIT NO. 2

KIT J—*Sea Witch*

KIT Q
Swallow

lifts sawed to shape..... 4.95*

V. Clipper *Sovereign of the Seas*, 20½-in. hull, with lifts sawed to shape..... 4.95*

Y. Trading schooner, three-masted, 17½-in. hull 4.90*

SIMPLIFIED SHIP MODEL KITS

F. Liner S.S. *Manhattan*, 12-in..... 1.00

H. Cruiser U.S.S. *Indianapolis*, 12-in... 1.50

J. Clipper ship *Sea Witch*, 13-in..... 1.50

MODEL-OF-THE-MONTH KITS

M. Aircraft carrier *Saratoga*, 18-in..... 1.00

N. Four U.S. destroyers, each 6¼-in... .75

O. Liner S. S. *St. Louis*, 11-in..... 1.00

P. Cup yacht *Rainbow*, 7½-in..... .75

R. U. S. cruiser *Tuscaloosa*, 11¾-in... 1.00

S. S. S. *Savannah* (first steamship to cross Atlantic), 3½-in., and S. S. *Atlantic*, 6-in. (two models in one kit)..... .75

T. U.S.S. *Brooklyn*, armored cruiser in Spanish American War, 8-in..... .75

U. *Hispaniola*, the ship in "Treasure Island," 7-in..... .50

X. S. S. *California*, 12½-in..... 1.00

Z. H.M.S. *Bounty*, 11½-in..... 1.50

FURNITURE KITS

No. 2. Solid mahogany tray-top table 23 in. high with a 15 in. diameter top. Ready to assemble, but without finishes..... 5.40*

No. 4. Solid mahogany book trough 22½ in. long, 9½ in. wide, and 24¾ in. high over all. Ready to assemble and stain included..... 5.75*

No. 5. Solid rock maple hanging wall rack with one drawer, 19½ in. wide, 33¼ in. high. Ready to assemble and stain included..... 5.75

No. 6. Solid rock maple butterfly table, top 19 to 22 in., height 22½ in. Ready to assemble and stain included..... 6.90*

NOTE: If you live west of the Mississippi River, add 50 cents to all prices marked with an asterisk (*) because of the heavy shipping charges. Otherwise all prices are postpaid anywhere in the United States. The kits marked with an asterisk will be sent C. O. D. upon request, but the purchaser will have to pay 28 cents additional upon delivery.

Popular Science Monthly,
381 Fourth Avenue, New York, N. Y.

Please send me Kit.....for which I inclose $.....(or send C. O. D. ☐)

Name .....

Address .....

City..... State.....
(Print name very clearly.)

Please remember that no kits can be sent C. O. D. except as noted above. This offer is made only in the United States.

GRACEFUL *Garden Chair* BUILT FROM SCRAP LUMBER

By Herman Hjorth

This new design for a garden seat is lighter than the common Cape Cod chair and can be made of odds and ends

WHEN the weather begins to get warmer and the days become longer, it is pleasant to sit in the garden, provided one has a comfortable seat. The garden chair shown in the accompanying drawings meets the essential requirements and is designed to withstand dampness and rain. It calls for less material, is lighter and more graceful, and can be moved about easier than the common Cape Cod chair. Odds and ends left over from other jobs may be used; and as it is to be painted, several kinds of wood may be combined. The main essential is that the seat supports and the two front legs should be made of fairly strong, straight-grained lumber, free from knots or other defects.

The two seat supports are laid out according to the pattern, sawed to shape, and smoothed. The slats for the seat are then nailed or screwed in place. Two hardwood wheels are bolted to the ends forming the rear legs. These, however, are optional and may be omitted.

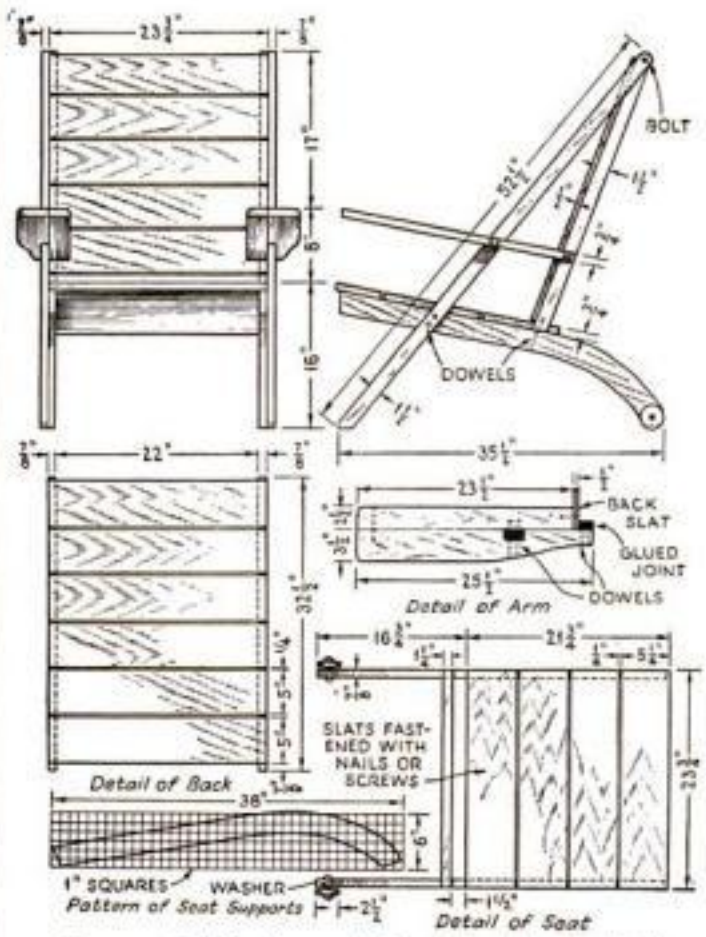
The pieces for the back are then cut and fastened together in the same manner. The lower ends of the uprights rest on the seat supports and fit in between the last two slats. The pieces forming the front legs are bolted to the upper end of the uprights.

The chair is now put together and adjusted so that the front of the seat is 16 in. above the floor, and the front and rear legs 35½ in. apart (outside measurements). Nail the front legs temporarily to the seat supports and plane the ends of the back until it fits on top of the seat supports. Then fasten these parts permanently with dowels as shown.

The arms are each made of two pieces, glued and doweled as indicated in the detail. Use only waterproof casein glue.

After a final sanding, the chair is painted with a good grade of outside paint of the desired color. Be sure that every part of the chair is well covered to prevent rotting. After the first coat (the priming coat) has dried, all holes in the surface should be filled with a good crack filler or putty. The surface is then sanded with No. 2/0 sandpaper. Two or three additional coats of paint will be necessary.

The garden chair may be made more comfortable by covering seat and back with detachable cushions. These may easily be made by stitching two layers of an old quilt together and covering them, preferably with waterproof material.



Front and side views of the chair, details of the back, seat, and arms, and pattern of seat supports

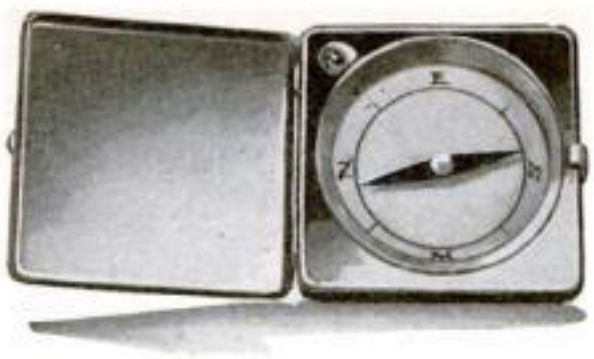
List of Materials

No. of Pieces	Description	T.	W.	L.
1	Two seat supports	⅞	9	38
4	Slats for seat	¾	5¼	23¾
1	" " "	¾	1¼	23¾
2	Uprights for back	⅞	1½	32½
6	Slats for back	½	5	23¾
2	Front legs	⅞	1½	52½
2	Arms	¾	3½	25½
2	"	¾	2½	23½
2	Wheels	½	2½	2½
4	Carriage bolts, ¼ x 2			

NOTE: Dimensions are given in inches and are finished sizes.

CLEANING LACQUER

STAINS cannot be removed from lacquered pieces with alcohol because of its effect on the finish. When water alone will not remove the stain, try carbon tetrachloride. This liquid will not harm the finest lacquer finish, and can be used freely in cleaning articles such as typewriters, beverage trays, and objects of celluloid. Don't use it on varnish, however.—K. M.



POCKET COMPASS FITTED INTO OLD COMPACT

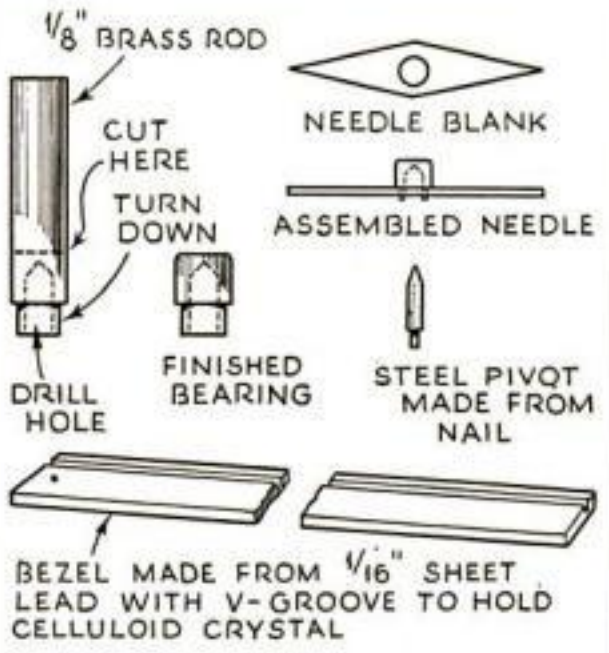
ANY boy can easily make a neat, good-looking pocket compass to carry on trips in unfamiliar country or for use in electrical experiments. The chief requirement is a lady's discarded compact. The dial, needle, and bearing can be taken from an inexpensive commercial compass, or made by the following method:

Draw the dial on white paper or cardboard and glue it to the bottom of the compact. For the needle, use steel from the comparatively soft back of an old tubing saw blade or flexible-back hack saw. First drill a hole for the bearing, then file and grind the needle to shape. The bearing on which it swings is made from a piece of ⅛-in. brass rod. A hole for the pivot is first drilled in the end of the bearing, after which it is turned or filed as shown and riveted to the needle. The pivot is made from a brad filed to a point and riveted to the bottom of the compact.

The needle is now magnetized by drawing it several times across a magnet. Locate its north pole, paint it red, and set the needle on the pivot.

The top of the compass consists of a circular disk of transparent celluloid held in a bezel made of a strip of lead, ¼ in. wide and 1/16 in. thick. A groove for the disk is cut in the lead near its edge with a sharp knife drawn along a ruler. It is then wrapped around the disk and pressed into the compact.

Compacts differ so much that no dimensions can be given for the disk, needle, and length of bezel, but the same method will serve in all cases.—DICK HUTCHINSON.



How the compass needle and bezel are made

FLUX FOR SOLDERING

ORDINARY zinc-cut acid, used as a soldering flux, will usually corrode delicate metal surfaces on which it is used. In such cases use 1 oz. of zinc chloride, chemically pure, dissolved in 3 oz. of water. This does not contain as much free acid as does the ordinary flux, but retains all of its advantages for soldering.—G. S. G.

MINIATURE MODEL OF H. M. S. *BOUNTY*

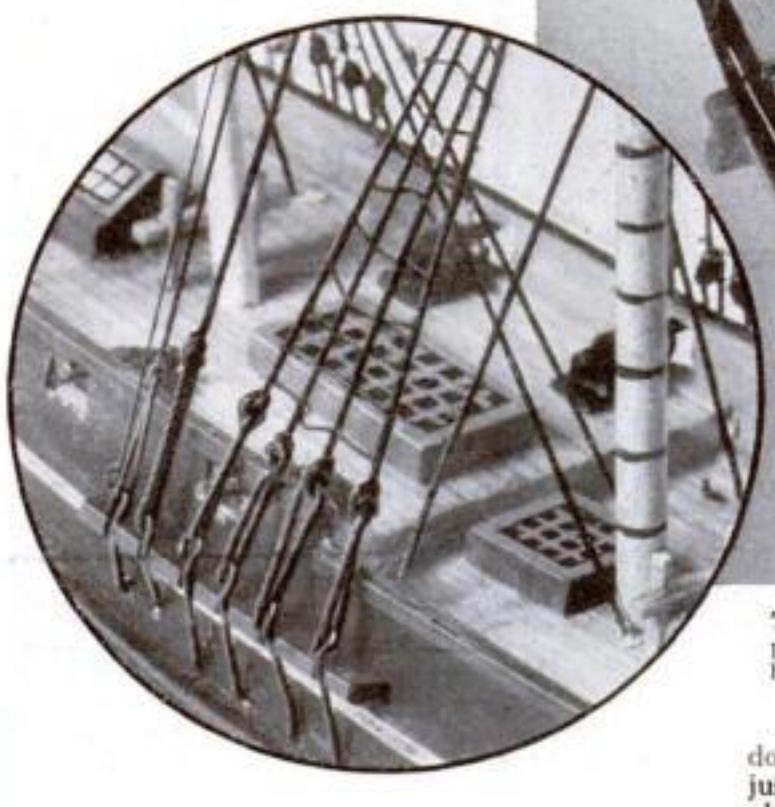
(Continued from page 59)

doublings are white. The driver boom and gaff are brown, and all yards black.

The masts from the tops and crosstrees up are filed square. I squared the heels of the masts also, because they stay in position better.

Two thicknesses of cord and some No. 70 mercerized sewing cotton should be used for the rigging. A sufficient guide for size is that the higher the cord starts, the thinner it should be. Standing rigging is black; running rigging (that which does, or should, go through blocks) is white or light brown.

To simulate deadeyes for the shrouds, I made chain plates of No. 20 wire, each with an eye to lie on the channel. The lower ends are bent to a right angle and stuck in the hull. If they are inclined to slip out, drive a small pin into the same hole. The shrouds go up through the top, down on the same side, through the eyes and are knotted at the height indicated. I found a rolling hitch the best knot to make at the exact height.



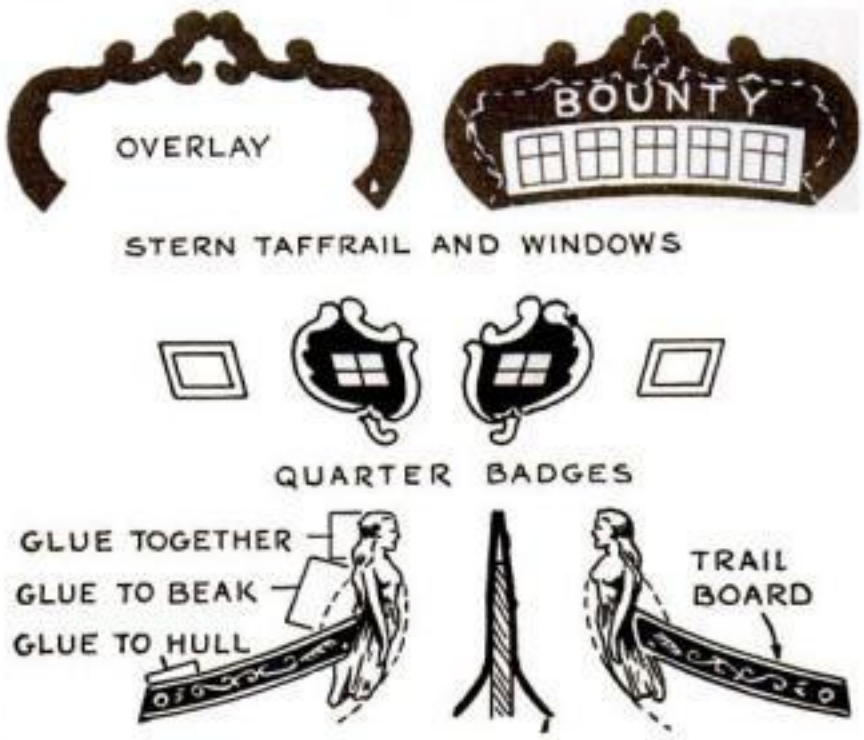
Top view to show deck fittings and position of spars; and, left, shrouds, hatches, guns, bitts, and other details

Another easier way to set up the shrouds is to bore holes in the hull, point the ends of the shrouds in them, and fasten by driving in glued toothpicks. In this case the deadeyes are represented by beads strung on the shrouds and glued in position. Use the toothpick method also for fastening the main and mizzen stays and Bentinck shrouds to the deck, and the headgear to the hull.

The forestay is double and knotted under the bowsprit. The fore-topmast stay is also double, knotted similarly, then twisted, carried down to form the bobstay, and tied to a hole in the stem. The other two stays go through the jib boom and through the dolphin striker and back to the hull just back of the catheads. The dolphin striker is a broken needle with a large eye, the end being thrust in a hole in the bowsprit cap or bowsprit.

The yards are fastened to the masts with a loop of thin wire, which starts abaft the mast. The ends are carried around the yard on either side, and then twisted together back of the mast again.

The royal and *(Continued on page 85)*



How stern of the model is ornamented. The windows can be cut right out if desired and transparent wrapping fastened behind

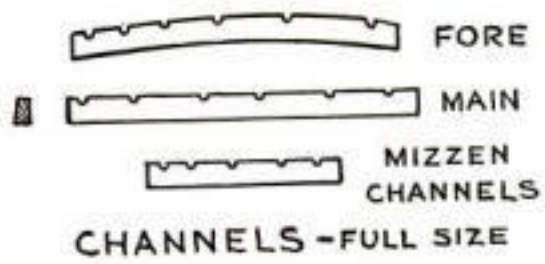
MODEL OF THE *BOUNTY*

(Continued from page 84)

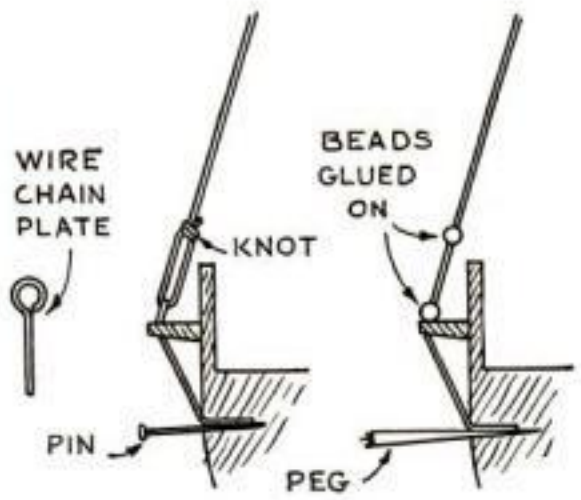
topgallant lifts and braces are each in one piece, with a half-hitch at the masthead and another at the yardarm. They are then carried back to the next mast and there knotted together. The lift part should be blackened. A touch of thin glue at all knots enables one to cut the ends off close.

The topsail and lower lifts (of medium cord) are separate, and the braces go through blocks or beads at the yardarms. Those at the main are tied to holes in the bulwarks. All the mizzen braces, of course, should lead forward.

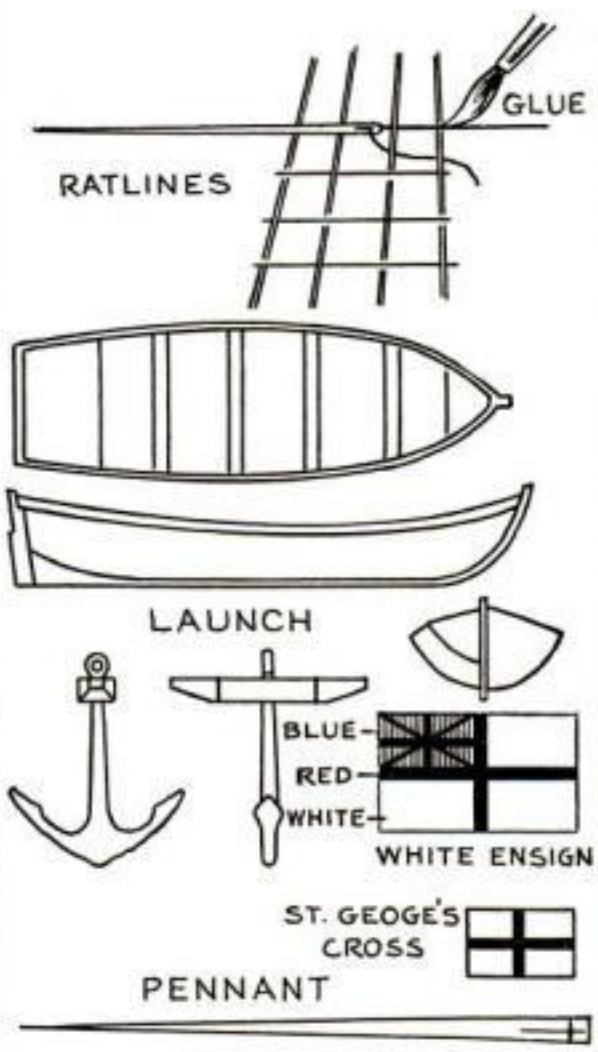
The topmast shrouds I put on in the old-fashioned way, with Bentinck shrouds to hold the ends. Make a *(Continued on page 86)*



CHANNELS - FULL SIZE



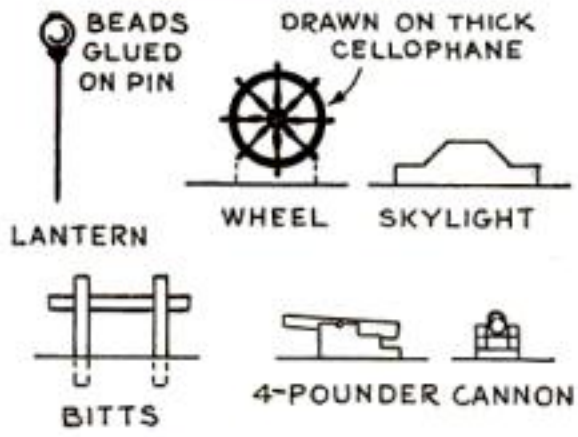
TWO METHODS OF FINISHING SHROUDS



Full-size details. Although the launch is shown, the model will look better without it

MODEL OF THE *BOUNTY*

(Continued from page 85)



Full-size drawings of the wheel, skylight, four-pounder guns, bitts, and two lanterns

bowline in the end of a piece of cord. Hold it as indicated in a drawing on page 58 and peg the end to the deck. Then hitch a piece of thin line to the bowline, reeve it through the top, over the crosstrees, down the other side, and through the eye of the other Bentinck shroud. Continue back up and so on until there are three a side. The topmast shrouds may have ratlines if desired. Topgallant shrouds may be omitted. I put them in and merely knotted the ends under the crosstrees.

The anchors are most easily made by cutting them out of scraps of sheet lead, with wooden stocks. The stocks are shaped, then split in two and glued on the shanks. The rings are tied with a cord through a hole in the cathead, and the arms are lashed to the forward chain plate. Heavy cords are carried from the rings and have their ends glued in the hawse pipes.

The flags can be painted on tracing paper. Those at the mastheads are glued to the poles, and the ensign to a signal halyard from the gaff end. They are the British white ensign, the St. George's cross, which is red on white, and a long pennant, half of which is blue and the remainder (out to the point), red.

The famous launch in which Capt. Bligh made the forty- *(Continued on page 87)*

List of Materials

Hull—1¼ x 2 x 7½ white pine or balsa.

Fittings—Scraps of semihard wood such as gumwood as follows: 1/16 x ⅛ x 6¾ for keel; 1/16 x ½ x 1⅝ for sternpost and rudder; 1/16 by 1 by 1¾ for stem; 3/32 x ⅝ x 3¾ for hatches, etc.; 3/32 x 3/32 x 1 for catheads; 1/16 x 1/16 x 4½ for bitts; 5/32 x 5/32 x 1½ for gun carriages; 3/32 x ⅛ x 16, preferably chair caning spline, for moldings.

Miscellaneous—Cardboard 2½ x 8¼ for bulwarks, stern, etc.; 2 pins, 2 large beads, and 2 small beads for lanterns; ⅛ diameter x 28 dowel and 8 doctor's applicators for spars; celluloid or fiber 1/16 x 1½ x 1¾ for tops, caps, etc.; sheet lead ¾ x 1½ for anchors; ½ in. long pins; glue; black, white, tan, and copper paint; varnish.

Rigging—12 ft. heavy black cord about as thick as No. 22 wire and 18 ft. medium black cord about as thick as No. 30 wire (or 30 ft. of black cord between these two in thickness); 5 ft. medium white or brown cord; 6 ft. thin black mercerized sewing cotton (No. 70); 6 ft. thin white or brown mercerized sewing cotton (No. 70); 6 ft. of No. 20 brass wire for chain plates, if wire chain plates are used; 18 in. of No. 26 copper wire for parrels, etc.; 14 small beads for blocks; 68 beads for deadeyes if bead deadeyes are used.

Base—¼ x 2 x 2¼ hardwood and 1 dowel 3/16 diameter x 9½.

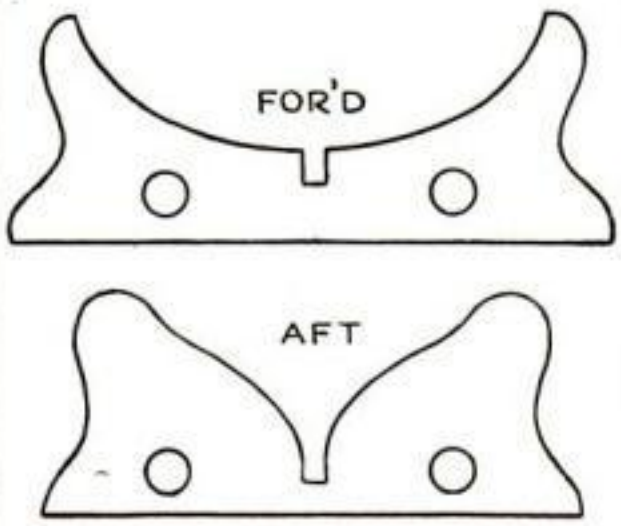
NOTE: Dimensions are given in inches except where otherwise noted.

MODEL OF THE *BOUNTY*

(Continued from page 86)

three day voyage is so large that I did not put one on my model. However, I give its lines for those who wish to make it. It would rest in the waist and occupy most of it. On the other side there should be a cutter, somewhat similar but smaller.

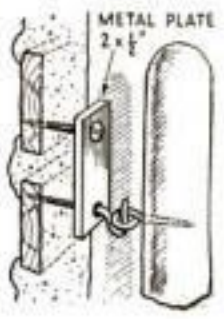
There is not space to describe here the fitting of every detail, but I think that this is sufficient to enable you to make a shipshape little model of H. M. S. *Bounty*.



The shaped parts of the stand. These are joined with two 3/16-in. dowels, 4½ in. long

FASTENING SCREW HOOKS IN PLASTER WALL

WHEN it is desired to drive a screw hook into a plastered wall and it cannot be set into a wooden stud or beam, the following method will insure its solidity: Get a two-hole iron mending plate about ½ by 2 in. Screw the hook into the wall through one hole and then, with the plate vertical, fasten the plate with a wood screw through the other hole, which should be above the hook. Both screw and hook should be firmly set in laths. The plate supports the shank of the hook and prevents its being pulled down and out.



Metal plate supports screw hook

This method was used in one case for hanging up a vacuum cleaner in an unused corner. A stout screw eye was set into the front of the handle a few inches from the lower end. When the cleaner is hung up, the handle is in the same relative position with the machine as when it is depressed to its lowest position to get under furniture. The hook in the wall is placed at such a height that the machine will just clear the floor when in place, thus eliminating unnecessary lifting.—ARTHUR L. FORD.

THIN VENEERS GLUED WITHOUT CLAMPING

BY A SIMPLE method that is practically unknown among amateur mechanics, thin wood veneers may be applied without a press or the use of heavy clamps. It is intended, of course, for relatively small work, overlays, and the like, rather than veneering large panels. The veneer is first cut in the exact sizes to be used and the backs are given an even coating of a good grade of liquid glue. When this is dry and everything is in readiness, the glue surface is moistened with a wad of cotton and, when it becomes tacky, is pressed in firm contact with the wood to be covered. Place a sheet of brown paper over the veneer and press it with a hot flatiron until perfectly smooth.—K. L. ROBBINS.

MODERN STEREOSCOPIC PHOTOGRAPHY

(Continued from page 70)

another exposure, you can learn how the insect might look to a midget whose eyes are on ⅛ in. centers. When viewed through the stereoscope, the insect appears to be many times its normal size. If you photograph the room of a doll house on a base line of about ¼ in., the room will appear normal size when seen through a stereoscope.

Stereoscopic illustrations probably will be used more widely in textbooks and other publications than at present, because they convey so much more information than the ordinary picture. In fact, an automobile manufacturer recently issued a catalogue containing several stereoscope illustrations of cars, chassis, engine, and mechanical parts. The pictures, printed in two colors, are viewed through two-color spectacles that render the resulting plastic picture in black and white.

No phase of photography offers more thrills to the amateur than that of three-dimensional picture making. As long as you limit your efforts to things that do not move, you can employ any camera that produces fairly sharp pictures.

Suppose you want to photograph a house in three dimensions. Simply snap a picture of it; then step a few inches to the right or left and snap another. When the prints are made, place them side by side and view them through a stereoscope.

"How far shall I move for each exposure?" you ask.

That depends on the actual distance of the object from the camera and the distance you want it to *appear* to be when you look at the picture. You can employ a simple formula to figure out the proper separation of viewpoints. Here it is:

$$I = \frac{2\frac{1}{2}F}{F'}$$

where I = the distance in inches the camera lens must be moved between exposures.
F = Actual distance of the object from the camera, in feet.
F′ = Apparent distance in feet you want the object to be when you look through the stereoscope.
(The factor 2½ refers to the normal separation of human eyes, in inches.)

SUPPOSE you are 100 ft. from a statue and want it to appear only 2 ft. away when you look at its picture through the stereoscope. The separation of the camera lens in inches equals 2½ times 100 divided by 2, or 125 in.

If you want to see an object in its normal perspective, the separation should be 2½ in., or the normal spacing of the eyes.

If you cannot conveniently obtain a stereoscope—and there are many varieties in existence—you can make an efficient mirror type instrument for a few cents. This stereoscope is, in principle, exactly the same as the costly instruments used in military work and other aerial surveying operations. No expensive lenses are required, and the instrument is easy to use.

Two small handbag mirrors about 2 by 3 in. and two larger mirrors about 6 by 9 in. are required. For the framework, you will need a few feet of 1 by 1½ in. strips of white pine, poplar, or other easily worked material; also a few wood screws and some ¼-in. plywood or similar material for supporting the mirrors. The construction is shown in the illustrations. The idea is to arrange all mirrors so that they are inclined at an angle of 45 deg. to the vertical (or horizontal). The two small mirrors are placed close together, with space between them for the observer's nose, and mounted with their reflecting surfaces outward and upward. The larger ones are mounted with their reflecting surfaces inward and downward, and their centers are in line with the centers of the smaller mirrors. The distance from the table surface to the large mirrors and from the large mirrors to the small ones may be about 7 in., measured between centers of the glass. For convenience, you can fasten the parts of the frame together with bolts and wing nuts so that it can be dismantled and folded.

To use the stereoscope, place the right-hand print of the stereo pair under the right mirror, and the left-hand one under the left. Move them about until their images merge to produce a plastic picture. The prints may be of any size up to about 8 by 10 in., and they need not be trimmed or mounted. Make the prints on either matte or glossy paper. Extreme gloss sometimes causes troublesome reflections. When making enlargements, be sure that objects in both pictures of a pair are the same size, and that the prints are approximately the same density.

The ambitious amateur photographer may pick up a few dollars by promoting some phase of stereophotography in his neighborhood. Perhaps he can persuade a real estate dealer to buy an inexpensive stereoscope, and award him the contract of making stereographs of houses that are offered for sale. A prospective customer, by glancing at a house picture through a stereoscope, can obtain an excellent idea of how it looks.

If the photographer has a twin-lens camera for snapshots of moving objects, he may be able to get numerous orders for photographing children, pets, and people in action. An inexpensive stereocamera can be made by binding together two box cameras of the same size, inverting one so that the shutter controls are on the outside, and connecting the shutter release levers together so that they both can be operated at the same instant.

More Prizes Awarded For Good Photos

IN THE second of our winter series of photo contests (P. S. M., Dec. '34, p. 78), excellent prints were submitted covering a wide variety of subjects—indoor views, landscapes, portraits, still-life studies, action pictures, and various novelties. Prizes have been awarded as follows:

FIRST PRIZE, $25
Ralph H. Anderson, Yosemite National Park, Calif.

SECOND PRIZE, $15
Samuel P. Zito, Niagara Falls, N. Y.

THIRD PRIZE, $5
A. Zachary, San Francisco, Calif.

FIVE PRIZES, $1 Each
C. A. Sawyer, East Orange, N. J.; Stanley V. Hilliard, Troy, Idaho; William Deppermann, Orange, N. J.; G. A. Haraden, Manchester, Mass.; F. C. Heidenreich, Montrose, Calif.

HONORABLE MENTION—*A. S. Anderson, Sioux Falls, S. Dak.; Cornelia Clarke, Grinnell, Iowa; Bernard B. Conheim, Chicago, Ill.; Lyle Fowler, Brooklyn, N. Y.; Marrett Miller, Louisville, Ky.; Mac Olds, Ypsilanti, Mich.; Doris Samter, Elkins Park, Pa.; Allan C. Shane, Beaver, Pa.; H. J. Stephenson, Minneapolis, Minn.; W. Edward White, Plymouth, N. H.*

The winners of the January Contest will be announced next month.

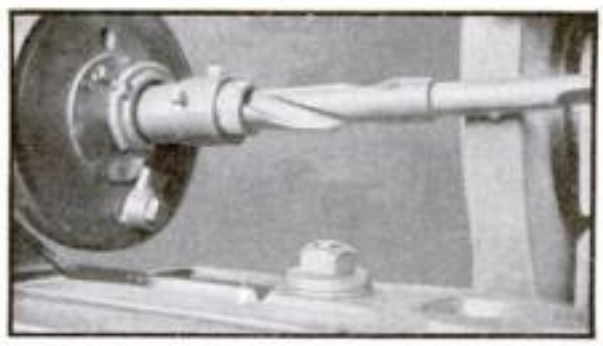
RUBBISH BURNER ALSO HOLDS GARBAGE CAN

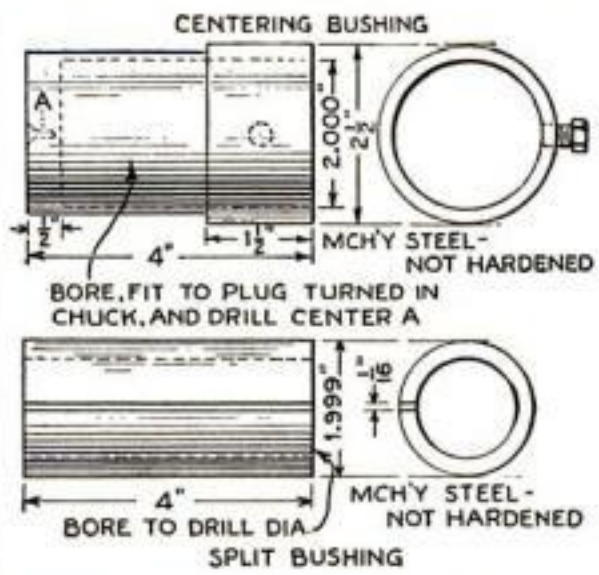
The garbage can is at a convenient height and cannot be upset by dogs and cats

THIS combination garbage-can holder and rubbish burner is one that dogs and cats cannot upset and it has a rustic appearance that harmonizes well with surrounding objects. A 1:3 mixture of cement and sand was used as a binder, and the old bricks were spaced sufficiently apar' in horizontal rows to permit ventilation and prevent undue smoke when the device is used as an incinerator. Note that the lower opening was formed by letting the bricks project progressively to avoid using a metal lintel. A piece of scrap iron was placed across the flue below the top to support the can at the proper height.—EARL E. MOORE.

TURNING AND GRINDING LARGE DRILL SHANKS

IN THE smaller shops where the supply of drills, especially in the larger sizes from 1 to 2 in., is limited, it is often necessary to reduce a tapered shank to a smaller size or change it to a straight shank. This can be done more quickly and easily if a combination bushing is made as shown.—H.J.C.





Combination bushing for holding the point of a drill while turning and grinding shank

JUDGES NAMED FOR GUILD CONTEST

(Continued from page 67)

settlement and later was author of *The Dawes Plan in the Making.*

Mr. Taft is a famous sculptor. He designed the Columbus Memorial Fountain, Washington, D. C., the Ferguson Fountain of the Great Lakes, Chicago, the Thatcher Memorial Fountain, Denver, the Fountain of Time, Chicago, and other great monuments. He has served as a member of the National Commission of Fine Arts, Washington, D. C., and is a member of the American Academy of Arts and Letters, the National Sculpture Society, and other organizations.

Tony Wons is nationally beloved for his radio broadcasts and readings from his scrapbook, and is an inveterate home worker. Dr. Bundesen also is well known throughout the country because of his radio talks. He is president of the Chicago Board of Health.

Edward F. Worst is director of industrial arts, Chicago Board of Education. He has long been one of the leaders in the manual training field and has written many standard textbooks on industrial arts. Mr. O'Brien is an enthusiastic supporter of the home workshop movement and has repeatedly called attention to the value of this hobby in a daily column he writes for the "Chicago Daily News." Donald A. Price is one of the country's leading amateur craftsmen.

L. W. Wahlstrom is another nationally known teacher of industrial arts. He was formerly president of the American Vocational Association.

Thomas E. Tallmadge, F.A.I.A., is a distinguished Chicago architect who has designed many churches and other public buildings, served on numerous important art commissions, and lectured and written extensively on the history of architecture.

Five new members have been added to the Guild's national contest committee—P. F. Hirsch of the Newcastle (Calif.) Homeworkshop Club; H. DeVere Shaw of the Bison Homeworkshop Guild, Buffalo, N. Y.; Merle Hedrick of the Saginaw (Mich.) Homecraft Club; Joe Sparrow of the Flint (Mich.) Homeworkshop Club; and Wallace Scherer of the Homecraft and Modelmakers' Guild, Richmond, Va.

Toys made by the Middletown (Conn.) Club

The following new clubs have been chartered: Armstrong Homeworkshop Club, Hampton, Va.; Toledo Hobbyist Club, Toledo, Ohio; Ocala Homeworkshop Club, Ocala, Fla.; Spokane Homeworkshop Club, Spokane, Wash.; Borden Homeworkshop Club, Borden, Ind.; Kincaid Homeworkshop Club, Kincaid, Kans.; and Paradise Homeworkshop Club, Paradise, Mont.

Beckley Homecraft Club, Beckley, W. Va. At the club's first annual exhibition, the Popular Science Craftwork Medal was awarded to D. H. Harvey for a turned and inlaid smoking stand, an especially elaborate and beautiful piece of craftsmanship. A plaque by Dr. John R. Koch, president of the club, was awarded honorable mention. The plaque, which was hammered from 22-gauge copper, depicts the head and shoulders of Nydia, the blind girl in "The Last Days of Pompeii." A Dutch windmill constructed by J. T. Sigler and a library table built by Rupert Shockley also were given honorable mention by the judges.

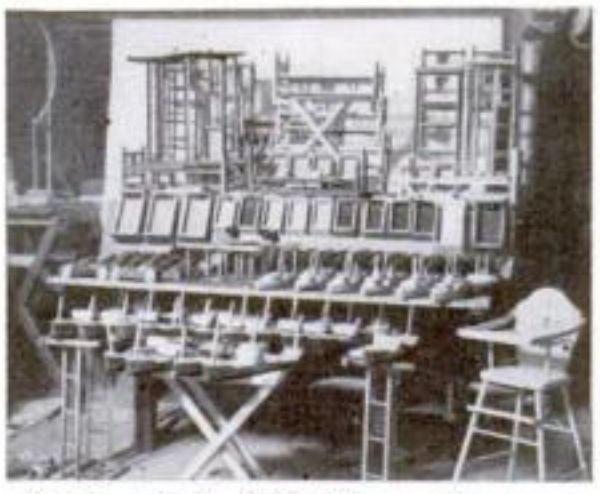
If You Live in Chicago,
VISIT the
GUILD EXHIBITION

RESIDENTS of Chicago and nearby communities are cordially invited to visit the first National Handicraft Exhibition of the National Homeworkshop Guild. It will be held in the Hibbard, Spencer, Bartlett & Company building, 211 East North Water Street, Chicago, March 25 to 30. Those not members of the Guild should plan to attend, if possible, on March 26, 27, or 29. Admission will be free.

Lexington Homecrafters, Lexington, Ky. The Frontier Nursing Service, which operates in the mountains of eastern Kentucky, helped distribute some of the 300 toys made by this club, and much of that part of the distribution was done on horseback. Some of the toys went to the most remote places in Kentucky. The Lexington churches also assisted.

Madison Homeworkshop Club, Madison, Wisc. The club has been divided into two teams that compete against each other for honors in club activities. . . . An extensive exhibition of the club's craftwork was shown in the annual Madison Hobby Show. A Hobby Council has been developed in Madison consisting of all the hobby clubs in the city, and the home workshop club is well represented. . . . To vary the shopwork, a class in card tricks is held after each meeting by Dr. H. S. Bostock, the president of the club, who is an accomplished amateur magician.

Topeka Homeworkshop Club, Topeka, Kans. Because of the wide range of activities conducted by this club, it has been particularly fortunate in the space devoted to it in the local newspapers. From time to time a column is given to the club under the heading "Topeka Homeworkshop" by the "Topeka State Journal." A typical column starts with a calendar of club meeting dates for the month; then follow notes about various activities, usually with some reference to the national program of the Guild; and finally, a few kinks of interest to home workers. . . . The junior division conducted in coöperation with the Y. M. C. A. is now a little more than a year old and has *(Continued on page 91)*



The Wood-Ridge (N.J.) Club gave these away

JUDGES FOR CONTEST

(Continued from page 90)

40 members. Any boy under 16 is eligible to enter, and the membership is free. Duane Montgomery is the president. . . . Thirty-five club members are enrolled in the photography class conducted by Steve Smith and C. J. Boeger. . . . One of the toys constructed by the club that has been a special hit is a swinging hobbyhorse. It can be hung from a tree or a rafter. Making these horses has been a specialty of David Gray. Other toys that were made in quantity by the club were ducks, pink elephants with blue ears, walking ducks, chickens that do stunts, climbing monkeys, and a variety of games. The major portion of the toys were turned over to the Shawnee County Parental Home.

Wood-Ridge Homeworkshop Club, Wood-Ridge, N. J. Between the regular business meetings of the club, informal meetings are held each week at the shops of various members. It was at such meetings that the club made the toys shown in one of photographs on page 90 for distribution to needy children. The work was under the direction of the club's informal meeting committee, of which H. G. Hoffman was chairman. He was assisted by A. M. Romme, who supervised the painting and finishing. The toys consisted of boats, automobiles, acrobatic clowns, cradles, beds, battleships, high chairs, ironing boards, and loose-jointed dogs. Most of these were copies of one-dollar articles found in department stores. The Men's Bible Class of Wood-Ridge aided in the actual distribution of the toys.

Antioch Homeworkshop Club, Antioch, Calif. To celebrate its annual meeting, the club held a banquet. . . . In coöperation with the local Parent-Teachers Association, the club gathered 100 toys and reconditioned them for distribution with Christmas food baskets.

Maywood Homecraft Club, Maywood, N. J. One toy made by this club proved so popular that practically everyone who saw it wanted to get one. It was a girl's sewing stand. The club constructed a number of four different toys—the sewing stand, a child's costumer, ring boards, and kiddy horses. Several members of the Maywood Parent-Teachers Association assisted in outfitting the sewing stands; and that organization, in coöperation with the relief committee, supplied names of the less fortunate children in the borough.

Patchogue Model and Hobby Club, Patchogue, N. Y. An exhi- *(Continued on page 92)*

ADVISORY COUNCIL

Professor Collins P. Bliss
Dean of the College of Engineering, New York University

Professor Clyde A. Bowman
Dean of the School of Industrial Education, Stout Institute, Menomonie, Wisc.

Harvey Wiley Corbett
Architect, New York City

Dr. Hugh S. Cumming
Surgeon-General, United States Public Health Service

Maj.-Gen. Benj. D. Foulois
Chief of the Air Corps, U. S. Army

Capt. E. Armitage McCann
Founder, Ship Model Maker's Club

Dr. Francis G. Pease
Astronomer, Mt. Wilson Observatory

Frank A. Vanderlip
Banker and Publicist, New York

JUDGES FOR CONTEST

(Continued from page 91)

bition was recently held in a store window. The work included model railroad trains in 0 and 00 gauge, boat models in bottles, tables, duck decoys, and original paintings in oil and water colors. The club also exhibited at the local high school during hobby week.

Manchester Homeworkshop Club, Manchester, N. H. At the organization meeting, 37 men attended and listened to an address by A. J. Moreau. Later another member joined, making 38 charter members in all. By the third meeting, the membership had increased to 46.

Alliance Homeworkshop Club, Alliance, Nebr. The first activity of the club was to stage an exhibition in a store window. A variety of projects were shown, among them a miniature castle in which a radio set had been incorporated. Woodwork, model making, decorative metal work, painting, and other varieties of craftwork were represented. By one actual count, 86 out of 120 persons who passed the store stopped and carefully examined the display. The fact that the local newspaper devoted two front-page stories to the club has also helped acquaint the residents of Alliance with the objects of the club.

Billings Homeworkshop Club, Billings, Mont. About sixty toys made by members of the club were distributed by the Elks Club, and many additional toys were given away by individual members of the home workshop club.

Brunswick Homeworkshop Club, Brunswick, Me. The organization meeting of this club, the first to be formed in Maine, was held at the Searles Science Building. Twenty men were present and became charter members. The second meeting was held in the manual training room of the local high school.

Leisure Hour Club, Manitowoc, Wisc. An exhibition of work done by members was given recently in a store window to call attention of prospective members to the club's activities.

Newcastle Homeworkshop Club, Newcastle, Calif. By the second meeting, the club had grown to eighteen members. As soon as there are twenty members, an exhibition will be held and the Popular Science Craftwork Medal given as a special prize for the best piece of handicraft exhibited. Although it is one of the youngest clubs in the Guild, entries will be made in at least three divisions of the National Exhibition and Contest.

Civic Homeworkshop Guild, Fort Wayne, Ind. The club has received many compliments for its work in making toys for needy children. Although it had only a limited time in which to work, the club members took hold of the project with such enthusiasm that approximately 150 toys were made and painted. They were given to the City Mission for distribution.

Tucson Homeworkshop Club, Tucson, Ariz. To encourage the club's membership drive, W. O. Watkins, the secretary, presented the club with a loving cup. This will go to the member who obtains the most members over a six-month period. It will become the permanent property of the member who twice gets his name engraved on it. . . . Leonard S. Raymond recently received two gavels, one being made from a piece of spruce window sash and a scrap piece of Spanish mahogany, the other from cocobolo wood.

Atlanta Homecraft Club, Atlanta, Ga. Plans for an exhibition in a downtown store window and a club contest for the Popular Science Craftwork Medal are being made. The club is also looking for a permanent meeting place. . . . The toy-building program gained favorable publicity for the club. Forty-five toys were made and distributed through the empty stocking fund of an Atlanta newspaper.

(Continued on page 93)

JUDGES FOR CONTEST

(Continued from page 92)

Fargo Homecraft Guild, Fargo, N. D. A class of ten members has been organized to take an evening course in metal turning at the State Agricultural College. . . . Interest in the club's activities is so great that every meeting since its organization has been well attended. The work the club is doing was made better known in the community through an exhibition given in conjunction with a flower show held by the local garden club.

Saginaw Homecraft Club, Saginaw, Mich. Twenty-seven entries are to be made in the National Exhibition and Contest. The club will be represented in all but two divisions.

Peekskill Homeworkshop Club, Peekskill, N. Y. The Popular Science Craftwork Medal was awarded to Robert Schrott for a canoe of the kayak type. The club exhibition, during which the prize was awarded, was held in the window of a hardware store. Mr. Schrott is planning to send his entry to the National Guild Exhibition in Chicago. About fifty projects were in the local display . . . Besides building new toys of its own for distribution to needy children, the club reconditioned a number of toys sent to it for that purpose by the Peekskill firemen.

Homecraft and Modelmakers' Guild, Richmond, Va. An average of five new members have joined the club at each of the last four meetings. Because of the growth in membership and the increasing activities of the club, a monthly paper is now being published, "The Chatterbox." At present it is issued in mimeographed form, but neatly set up with two columns to the page and a decorative heading. Robert H. Athearn is the publisher of the "Chatterbox," also the editor and printer. . . . Most of the 65 toys made to be given away by local charitable agencies were turned out on a production basis. One member, for example, cut all the wheels for the wagons. Another cut the rockers for the ducks, another painted the heads of the horses, and so on. . . . Dr. A. O. James, a member of the club who was formerly in charge of dental instruction at the Medical College of Virginia, has helped the other members with many hints. He has adapted methods from dental practice in making models. He is also chairman of the committee arranging for the annual exhibition at which the Popular Science Craftwork Medal will be awarded.

Snoqualmie Homeworkshop Club, Snoqualmie, Wash. Much interest has been aroused by a bird house building contest sponsored by the club. The exhibits were displayed in three store windows.

Spokane Homeworkshop Club, Spokane, Wash. This is the second club to be organized in Spokane under the auspices of the Guild. Among the twenty members are two manual training instructors and one semi-professional craftsman. C. W. Talbot, M. D., is the president.

If there is no home workshop club in your community and you wish to know the advantages of starting one with the aid of the Guild, fill out the coupon below.

National Homeworkshop Guild
c/o Popular Science Monthly
381 Fourth Avenue, New York, N. Y.

I am interested in the home workshop club idea and wish to know what the National Homeworkshop Guild will do for me. Please send me this information in the large self-addressed and stamped envelope I am inclosing.

Name .....

Address .....

City..... State.....

(Please print very clearly)

INDIAN WAR DANCE SHOW

(Continued from page 61)

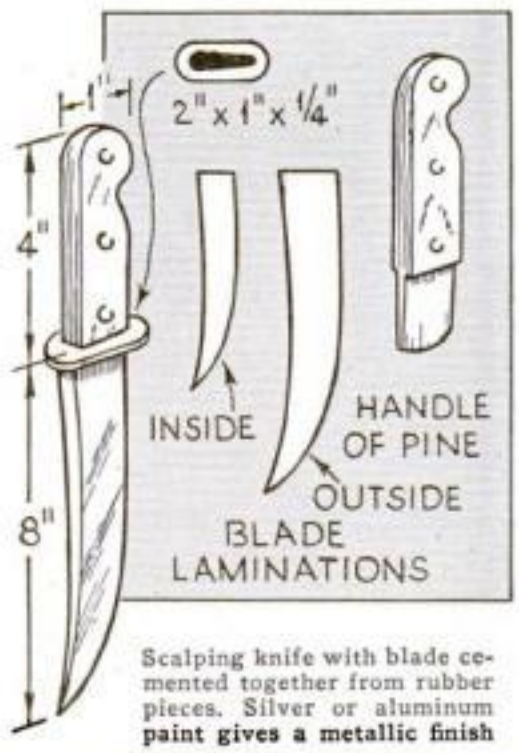
"Buckskins" made from a man's cast-off tan Palm Beach suit. An old felt hat forms the foundation for the costly looking headdress

cement the tabs to the sole with rubber cement. When the heel is reached, cut off any unneeded parts of the upper, and cement the sides together. Cement in the tongue, punch holes for laces, and apply decorations with quick-drying enamel. If a thicker sole is desired, a second or even third thickness may be cemented in place.

You will find it a great help to wet both the rubber and the knife or scissors while cutting.

The "cutting" edges of scalping knives, tomahawks, and spears should be trimmed to thin edges after the cement has dried. Silver or aluminum paint gives a genuine look to these harmless weapons.

Feathered headdresses are usually considered difficult or impossible to prepare, but a good imitation can be made from the following: the crown of a felt hat, two dozen feathers, a little quick-setting cement; small pieces of leather, oilcloth or silk ribbon; a piece of bright-colored flannel, some thread and a needle. Pierce the end of each quill with a large needle. Place a light coat of cement on a quill just below the vanes and bind on a neat little bunch of additional fuzz or down. Now cut a 2-in. (Continued on page 95)



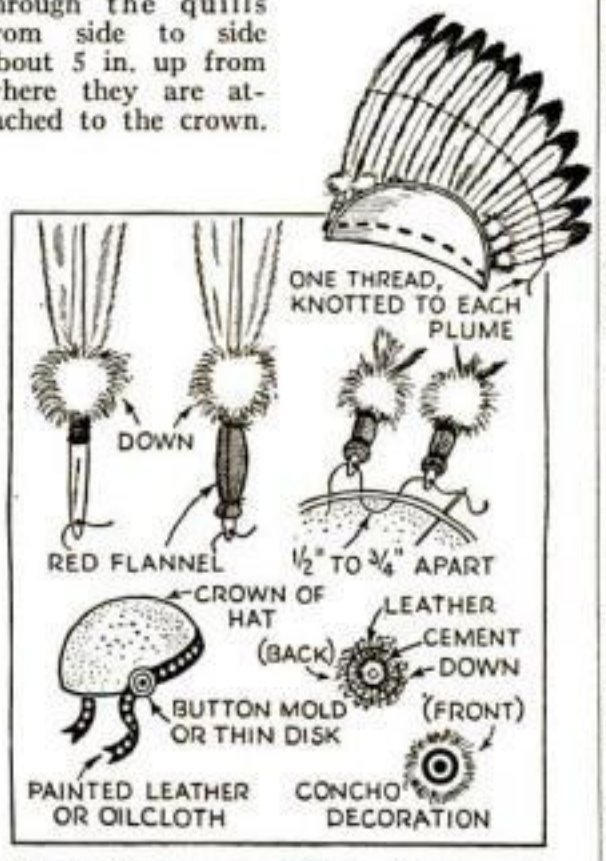
Scalping knife with blade cemented together from rubber pieces. Silver or aluminum paint gives a metallic finish

INDIAN WAR DANCE SHOW

(Continued from page 94)

square from the flannel, turn in the top and bottom edges, lay on a little cement, and roll the flannel around the quill, arranging the lap to come at the back of the feather where it will be unseen in the finished bonnet. Sew the quills to the hat crown 1 in. from the edge and 1 in. or less apart. Do not pull the thread too tightly. A narrow, decorated piece of leather, inner tube, oilcloth, or silk ribbon will finish the headdress at this point

Place the bonnet on some firm projection and run a long thread through the quills from side to side about 5 in. up from where they are attached to the crown.



How the feathers are individually decorated and sewn to the crown of a discarded felt hat

Draw in this thread until the plumes lie correctly. They should fall back smoothly, be free to swing easily forward, back, and sidewise, but should not stand stiffly straight up nor be separate one from another. Having settled definitely where each should lie, run in a second thread through the same holes and tie it to each plume as you go. The most striking effects are obtained with either goose or turkey feathers of pure white, the ends of which have been dipped in black dye or India drawing ink.

Cast-off tan or cream-colored Palm Beach suits furnish excellent material for buckskin hunting shirts and leggings. They should, of course, be considerably oversize for the boys who are to wear the costumes.

Have the boy put on and button the trousers. Pin in the excess equally over each hip and, from hip to ankle, pin in enough material to fit the leg rather snugly. Slip off the trousers and run several lines of stitching along the lines indicated by the pins.

Put on the coat; then turn up the collar and cut it off. Bring the front together and pin to a comfortable hunting-shirt fit. Leaving 2 or 3 in. for a fringe, cut away the excess. Now grasp the coat by the shoulders and lift it up until the upward movement is stopped by the lower sides of the armholes. Pin the excess again, running a line of pins straight out along the arms. The excess material at the back of the neck is converted into a fringe later. Take off the coat, stitch along the pinned lines, cut away the excess, and slash the fringes. Remove all pockets and fringe the bottom of the coat and the cuffs of the sleeves, shortening as necessary.

A piece of plank, roughly cut to shape, serves well as a rifle if inclosed in a fringed and decorated case made of material similar to that in the suit.

STAMPS AND COINS UNDER THE MICROSCOPE

(Continued from page 43)

all of the acid is neutralized by ammonia vapor, make the opening of the ammonia-bottle nozzle larger than that of the acid-bottle nozzle; draw out the nozzle of the acid bottle to a fine point, with an opening not much larger than a hair.

IF YOU are a coin collector, you will find a microscope convenient for deciphering dates and other inscriptions on badly worn coins, for identifying and comparing mint marks, for detecting irregularities that might affect the value of the specimen, and for determining whether the mint bloom is perfect or whether there is evidence of tarnishing and scratching. In extreme cases, it might even be desirable to polish the surface of a badly worn coin, to etch it very lightly with nitric acid or other standard etching solution, and then to use a microscope for deciphering the inscription by noting the crystalline arrangement of the metal.

If you are not a coin collector, but just a modern explorer who pokes into all manner of strange places with a microscope, you will find a coin to be a mine of interest. The quantity of grime an ordinary dime or quarter can collect is astonishing. Lurking in the corners of raised letters and numerals you generally will find an amazing amount of dust, no doubt teeming with millions of bacteria. You can see how money can carry disease.

At a magnification of fifty or 100 diameters you can study the tool marks made by the engraver when he cut the die. Compare such marks on several coins of the same denomination and type, and you will find a surprising variation. Even the shapes and sizes of letters and figures vary considerably. A coin under a binocular microscope suggests a relief map of hilly country. The familiar eagle's head of a half dollar becomes a mountain range; the plain below it is studded with thirteen star-shaped peaks.

As you look at coin after coin, you will be struck with the fact that, clinging to nearly every one, are bits of cloth fibers, crystal-like pieces of dust, and all manner of other materials. An ingenious microscopist could, by identifying such material, determine with fair accuracy something of the history of the coin's travels. A piece of money found in the pocket of a robbery suspect might reveal without a doubt that it had at one time been at the scene of the crime.

Stamps are, if anything, easier than coins to inspect with a microscope, because they generally can be treated as transparent objects, a strong beam of light being directed through them from the substage mirror. Of course, they can be examined also as opaque objects.

LOOK at the one-cent stamp you purchased with that penny, and you will find that it is not the uniform, steel-engraved picture of Yosemite Falls or Benjamin Franklin or George Washington you thought it to be. Each apparently solid line will be revealed as a series of ink splotches discoloring only the tops of the fibers that make up the paper. The power of the microscope to separate closely spaced lines which, to your eyes, look solid, is strikingly shown. Increase the magnification, and you can determine the form of separate fibers in the paper, particularly along the edges, where the stamp has been torn from others like it. If you are familiar with common fibers, such as those of cotton, wood, linen and silk, you will be able to identify the material from which the paper was made. By boiling the stamp in a sodium hydroxide solution, to remove the filler, you can sep- *(Continued from page 97)*

Always mention POPULAR SCIENCE MONTHLY when answering advertisements in this magazine.

STAMPS AND COINS UNDER THE MICROSCOPE

(Continued from page 96)

arate the fibers for better inspection. Because this process destroys the stamp, use a canceled one. Try the same method with nitric acid instead of sodium hydroxide.

To the true stamp collector, each tiny line in a stamp has a meaning. By studying such lines, he can tell much about the history of the stamp—when it was printed and what mistakes were made and corrected during the manufacture of the plate used in printing it. Although such details as evidence of double, triple or short transfers, recuts, cracked plates, and double impressions, frequently are rendered sufficiently visible by a hand lens, a microscope magnifying up to fifty diameters will be found more convenient and positive.

AS AN example of the tiny details for which collectors are ever on the watch, consider the 1917-19 issue of two-cent and three-cent United States stamps. On the toga draping the shoulders of the figure, near the bottom of the oval, is a button. In some of the buttons are five vertical lines, the tops and bottoms of the first and second, and fourth and fifth lines being connected, so that the pattern looks like the numerals *010*. In other buttons, the lines are not connected. On some three-cent stamps of this series the middle line in the button consists of two short dashes with a dot between; in other buttons the middle line passes through a dot, and the two lines on either side are made up of pairs of short dashes. These tiny details, revealed clearly by the microscope, determine the classification of the stamp in question.

Doubtless the ingenious stamp collector can find many other ways of using a microscope in his hobby. Perhaps he will find it desirable to measure the size of perforations with the aid of a micrometer eyepiece. The miscroscope may be of value in deciphering obscure cancellation marks, or in reading inscriptions under them. When highly magnified, a section of a stamp design, normally made invisible by the cancellation ink, takes on an entirely different appearance. Without difficulty, the engraved pattern of the stamp can, in most cases, be distinguished from the overprinted cancellation.

On the whole, this new form of entertainment with the microscope, will provide you with many an hour of enjoyment.

METEORITES MAY COME FROM OUR SOLAR SYSTEM

DID meteorites originate within our own solar system, or are they wanderers from outer space? New light is thrown on this controversial question by S. K. Roy, assistant curator of geology of the Field Museum of Natural History. He calculated the age of twenty-three meteorites,—that is, the time elapsed since they solidified—from a study of the radioactive substances they contained. None of them yielded values exceeding 3,000,000 years, which is a commonly accepted figure for the approximate age of the earth itself. The new evidence thus confirms the possibility that meteorites are disintegrated particles of our own highly-organized solar system.

CENTRAL AMERICAN PEAK VANISHES IN TEMBLOR

CRUMBLING in a cloud of dust, a whole mountain in Honduras disappeared during recent earthquakes. Witnesses reported that the peak, Monte Cerro Azul, sank from sight with a tremendous roar, heard for miles.

Secrets of Success

STORIES THAT WILL HELP YOU GET AHEAD

CAMERAS AND DOGS

CHELSEA is one of the older parts of New York to which its earlier residents have clung without much change. Children, grandchildren and great-grandchildren of some of Chelsea's original families still are neighbors. And as homes have passed from generation to generation, with them have been handed down antiques and priceless old furniture.

Since childhood, Ruth Cushman has always loved the old things in her father's house and in the homes of old family friends. It was quite natural that later, when she had found a mild amateur interest in photography, she should want to capture the beauty of these household treasures through the lens of her camera.

Some of her pictures were only fair; others surprisingly good, enough so that Miss Cushman determined to go further with her hobby. In her experimentation with photographic composition, she occasionally dragooned the family cat or dog as models . . . when the animals could be induced to hold a pose long enough. And that started her toward the specialization of her hobby—animal photography.

It was not until a few months ago, however, that Miss Cushman decided to improve her technique with professional instruction. Wanting to devote as much daylight to practical work as possible she enrolled for a home study photographic course which could be followed in the evening.

Part of the course taught the student to be on the lookout for new and unusual subjects, a point which is rather important in this story. It so happened that one afternoon late last Fall, Miss Cushman was sauntering along Fifth Avenue, in front of the New York Public Library with an eye out for something to photograph when that something walked right past her—a dog. Not the type of dog that would ever be benched by any kennel club. If you tried to guess his ancestry, you would be as much at a loss as anyone else in designating the breed. Just a dog, but with a personality that shone through a clouded past. On his back was a blanket. On the blanket, an appeal from the Humane Society.

Here was a subject and Ruth Cushman swung her camera into action. Interested, a representative of the Society accompanying the dog, asked her to take two more negatives in special poses. Though made hastily and under adverse traffic conditions, all three prints proved exceptionally fine.

Much pleased, the Society suggested that Miss Cushman call on three of its friends—a veterinarian specializing in dog dentistry, a dog-walking service and a canine catering service. (Yes, they have them in New York and incidentally they are all doing remarkably well!) Equally

Secrets of Success

as well pleased as the Humane Society, these three in turn recommended her to other new contacts.

Already a demand has been built up for her work . . . and, as this is written, she has been at it just four months! Unusual, yes. But there is nothing miraculous about the rapid strides Miss Cushman has made. A real interest, plus real determination, and intelligent planning have given this girl a start. Have you these qualities?

TAXIDERMY FOR FUN AND PROFIT

HUNTING was Carl Anderson's recreation. Whenever opportunity and North Dakota game laws permitted, you'd find him in the field with a rifle or shotgun. The only flaw was that he couldn't preserve some of the fine specimens he had shot.

Taxidermy then was no more than just a word to Carl. He knew nothing about it nor did anybody else in the neighborhood of the Anderson farm. But he could find out, and did. In one of the many magazines on the Anderson living room table, Carl found the advertisement of a home study course on mounting birds and animals, and decided to enroll.

Carl laughs now at some of his first fumbling efforts but as his skill increased with practice, friends began bringing him work. Now and then he would do an eagle, owl or prairie chicken. Occasionally he would have a coyote pelt or dog skin to be made into a rug. Once in a while the local zoo had a wild animal to be preserved. For three years he plugged away at it simply as a hobby.

In 1931 the State Game Department opened the season on deer along the Missouri River, sixty miles south, and hunters swarmed in from all over. Many of them came by automobile on the highway which ran past the Anderson farm and Carl, sensing the opportunity to turn his hobby into something more than just a pastime, hung out his shingle as a taxidermist. In addition, he ran a small notice in the local newspaper.

Within a few weeks, he had enough work to keep him busy all winter—heads to be mounted and hides to be tanned. Today he has preserved fifty-five deer heads besides many smaller game and bird specimens. A recent commission was from the zoo which decided to cut down the number of African lions in its cages. Four of the animals have been made into rugs and a majestic old male has been mounted whole as a mascot for the Lions Club.

Friends often suggest that Carl move in to town but he always says "No. There is no expense here and farming, after all, is my real occupation. Together with my hobby I can make a comfortable living. Besides, anyone who works with taxidermy should have constant contact with nature and wild life in order to give the mounted specimens the natural expression that only close observation of the live subjects can teach."—C.E.P., Minot, N. D.

IF ONE DOOR IS CLOSED, TRY ANOTHER

OTTO WEIST was in a tough spot. Prolonged illness, which drained his resources, coupled with the loss of his job put Otto pretty much up against it financially when he finally did get his health back. A good watch repairer by trade, he was able to get a little work from among his friends but it didn't amount to much. And there was no use moving to another town. He wouldn't be known and, so far as watch repairing was concerned, conditions were just as bad elsewhere.

But Weist hadn't made watch repairing his only vocational interest. More as an amusement than anything else, he had taken a course in photo-engraving and as he acquired skill became quite proficient at it. This was all before bad luck walked in his front door. Now, faced with the necessity of making a living by some other trade than that of a watchmaker, he started thinking about his hobby.

There were not many engraving plants in North Dakota. Newspapers were using a few cuts but not as many as they would like, because of the length of time it took to make them. Why not try to encourage the papers to dress up their pages pictorially? thought Weist. Bismarck, the capital, where Weist was located, was the biggest source of news in the State, and just at this time a fiery political controversy was raging. News! And pictures would make it that much more interesting.

By hard scraping, Weist got together enough money to buy equipment and set it up in his apartment. Next he took out a card in the district union. Then he started looking for business. The results were surprising. Not only were the newspapers interested but printers and advertisers, too. They found his work to be of high quality, thanks to the patience, care and precision that watch repairing had taught him.

He still carries on the watch repair work but today it is photo engraving that is giving him the bulk of his income.—B.K., Bismarck, N. D.

THUMB INDEX INDICATES LOCAL PHONE NUMBERS

MUCH time can be saved in finding local telephone numbers in a directory that covers a number of towns if a thumb index is cut out so that the first page of the home exchange can be located without hunting for it. To cut out the thumb space, open the directory at the first page of the local section and make a V-shaped notch in the preceding pages.—GEORGE A. SMITH.

When many towns are listed in one directory, a thumb notch saves time in finding your own

SOUVENIR COINS FORM NOVEL BRACELET

(Continued from page 69)

the borax is dissolved. Excess solder, if any, may be removed with jewelers' files, and the bracelet may be polished on a buffing wheel or by hand with jewelers' rouge. After buffing, wash the piece with soap and water and use silver polish.

A slip ring, which may be purchased at any jewelery store, is used to fasten the ends of the bracelet together. This ring is put on after the bracelet has been cleansed in the acid. It is best to soft solder (using a soldering iron) the link holding the ring. The heat necessary in hard soldering will destroy the temper of the spring in the ring.

Hard solder may be purchased from dealers in metal-craft supplies and from jewelry stores. A piece less than a 1/16 in. square is ample to make any of the joints. An easy flowing silver solder can be made by melting two parts silver and one part brass upon a charcoal block. When the silver and brass fuse, they will form a ball. While the ball is still molten, press it out with a flat piece of iron.

HOMEMADE SHOE CREAM INSURES GOOD SHINE

Applied either before or after an ordinary shoe polish, the cream improves the luster

A SHOE cream that will produce a lasting and lustrous coat may be mixed as follows: Take 1 part (say 1 oz. by weight) of shaved Castile soap and sixteen parts (16 oz. by weight or 1 pt.) of water and heat to boiling. Add 4 parts (4 oz.) of shaved carnauba wax to the soap solution. It will readily become creamy. Stir, and when still very warm to the touch, beat in from 10 to 15 parts more of water. Continue beating until the mixture is cold. The amount of the water last added will change the consistency to the desired point.

If the shoes need some preservative, or quickly lose their shine, it is best to rub on the cream first and then apply the shoe polish you ordinarily use. This emulsion impregnates the leather with the carnauba wax, and the regular blacking imparts the black color. If the regular blacking is applied first, which is also satisfactory, the cream cannot, of course penetrate as deeply, but it will, however, build up a brilliant waxy coat on the leather. It can also be used alone instead of the polish, but in this instance is best colored, for black shoes, with water soluble nigrosine dye, or left "as is" for other colors.

Fastening a piece of felt on the underside of the cork of the wide-mouthed bottle makes application of the cream very easy.—R. B. W.

REMOVING STAIN FROM HANDS

TO REMOVE wood stain from the hands, rub a little lubricating oil or linseed oil into the pores very thoroughly, then wash the hands with soap and water and rinse well in clear water.—WALTER J. PEARCE.

HERE'S THE ANSWER

(Continued from page 53)

many of the webs we see are built by the female. The female's web is likely to be much larger and stronger than the male's.

When Seeing Is Deceiving

J. L. B., WASHINGTON, D. C. Persons who have difficulty in reading often suffer from what is known as "word blindness." They have difficulty differentiating between such words as saw and was, broad and board, and gum and mug.

The Higher, The Colder

Q.—WHY IS it colder on top of a mountain, in spite of the fact that the sun is closer?—S. H. B., Brooklyn, N. Y.

A.—BECAUSE the air is thinner on a mountain top than it is at sea level; it does not hold the heat of the sun as well.

Coal Per Person

J. U. T., MEMPHIS, TENN. At the present time, approximately four tons of coal are used annually for every inhabitant of the United States. Because of the increasing use of oil and electricity, this figure is reduced every year.

What Is A Glass Snake?

A. W. G., Jr., SALT LAKE CITY, UTAH. The glass snake, which is not a snake at all but a lizard, comes by its name because of its brittle, highly polished, glasslike armor. When a glass snake is grasped by its tail, it merely snaps the member off with a twist and continues on its way apparently unharmed.

Not Much Left

A. K. V., CHICAGO, ILL. Carbon and water account for almost five sixths of the total weight of the average human body. The remainder consists of lime, phosphorus, salt, iron, sugar, potassium, sulphur, magnesium, fluorine, nitrogen, and iodine.

Will Venom Kill Snakes?

Q.—CAN one cobra kill another cobra with its bite?—G. W. H., Baltimore, Md.

A.—FEW animal's poisons are fatal to themselves or their species. One exception, however, is the scorpion. According to popular belief, the scorpion often commits suicide by stinging itself.

Feeling Temperature

W. O. F., CHICAGO, ILL. According to the latest theories, temperature is felt by the contraction and dilation of the blood vessels and not by a special skin mechanism as was one time thought.

Depends on Point of View

Q.—DOES the sun stand still, or does it move?—D. T. S., Dallas, Tex.

A.—IT ALL depends. As viewed from the earth, the sun stands still; we revolve around it. If the sun were viewed from the stars, however, it would be seen to move. With reference to the center point of the entire cloud of known stars, the sun moves about thirteen miles a second, but the earth and the whole solar system move with it.

HOME EXPERIMENTS WITH INTERESTING ALLOYS

(Continued from page 55)

such a way that it dips into the liquid. When all is ready, the two electrodes are connected to the terminals of a six-volt battery; the carbon to the positive pole and the nail to the negative.

Being positive, the carbon will attract the negatively charged chlorine portions of the solution and chlorine gas will be set free. The mercury, however, resting on the nail, will be negatively charged and will therefore attract the positive ammonium portion of the solution. Thus, the ammonium portion is set free, but, instead of escaping like the chlorine gas, it immediately amalgamates with the mercury.

DURING the first half minute that the current is on, the drop of mercury will appear unchanged. Soon, however, it will begin to swell and emit bubbles. For a minute or so, the drop will increase in size, expanding like a silver balloon until it is several times its original dimensions. Eventually, the mercury amalgam will float up through the solution only to drop down again to its resting place on the nail. This process will repeat itself again and again.

The alternate bloating and floating of the mercury amalgam is easily explained. It so happens that the ammonium amalgam is decomposed by the water as fast as it is formed, giving off ammonia and hydrogen gases which buoy the substance up, causing it to float. However, as soon as it reaches the surface, the gases escape and the mass sinks to the bottom of the container where it again comes in contact with the negatively-charged nail head and the entire cycle is repeated.

Incidentally, it is through this ingenious experiment that chemists have been able to study the properties of the curious ammonium group. No one has ever seen nor isolated the ammonium radical, or ammonium group as we have called it, but much has been learned from a study of its amalgam.

RADIUM IS PROPOSED TO DRIVE ROCKET TO MOON

A TWO-DAY trip to the moon, propelled by radium, is the fantastic proposal seriously advanced by Prof. Isidore Bay, Director of the Astronomical Society of Lyons, France. He declares that a rocket-like projectile could attain sufficient speed to leave the sphere of the Earth's attraction if propelled by sufficient radium to develop 414,000 French horsepower. The interplanetary projectile, he calculates, would not have to weigh more than two tons.

PEASANT-GIRL CHEMISTS MAKE POLISH FROM FISH

NAIL POLISH obtained from fish is a new product in Yugoslavia. Peasant girls discovered a pearly polish could be made from fish which swam in Lake Ohrida. Now the material is being prepared for the market. It is reported the fish used are found only in this one lake.

TEN-FOOT TREE STUMP BRINGS SMALL FORTUNE

ONE black walnut stump recently brought its owner $3,800. The stump, taken from the ground in Virginia, measured ten feet across after the roots had been cut until a solid mass remained. Black walnut is growing scarcer each year, and is invaluable for making gunstocks and airplane propellers. The wood in a stump where the roots begin to branch is said to be the most valuable of all.

MAKING A MERCURY BAROMETER

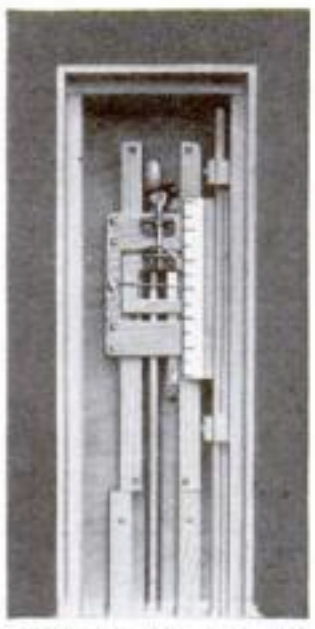
(Continued from page 65)

sharp eye on the column while this is being done, for if by accident a bubble of air enters the tube, it will have to be filled again. This will not happen if the open end is kept below the cistern level at all times.

Remove the cardboard disk from the bottle by fishing it out with a pointed wire, for if this is not done it may act as a check valve to prevent the inflow of mercury when the column rises.

If the barometer is set up in fair weather, the bottle may overflow in times of low pressure, since a falling column means a rise in the cistern level. To prevent such waste, suck out enough mercury with a medicine dropper to lower the cistern level to ¾ in. in good weather.

When the bottle has been pushed back into place, screw down the lid. Tie a collar of fluffy cotton around the tube and push the cotton down against the cap to keep out dust.



Indicator at top of the improved barometer

All that remains is to arrange a reading scale. This may be nothing more complicated than a yardstick hung from a nail in the back. A much better plan is shown in the drawing. Here the yardstick has been pierced by two slots and permanently screwed to blocks inside one guard strip, with a wing screw (which may be a common screw with a metal fin soldered in the slot) in the lower one to clamp it with. Since a barometer is read to tenths of an inch, the six inches of the stick where the movement of the column top takes place is covered with a scale of tenths glued and bradded on.

To read the barometer, loosen the wing screw and shift the scale to bring the zero mark even with the crown of the mercury in the cistern. Then note the height of the column, again reading to the crown of the mercury curve.

YOU may also add, if you wish, a sliding pointer of some kind that can be moved to the level of the mercury whenever you take a reading. The next time you look at the barometer you can then tell at a glance whether the mercury is lower or higher, and that is frequently all you wish to know.

The scale gives all the reading required to keep a record of atmospheric pressures in your own locality. However, if you want to compare it with barometer readings in other places as reported in newspapers and shown on weather maps, you will have to figure what the reading would be at sea level with the thermometer at 32 deg. F., because official barometer readings are all reduced to this standard. In fact, for precise work, they are further corrected to 45 deg. latitude, but such correction is so slight that you may disregard it. The following simple rules are for standardizing:

1. Temperature. Mercury expands with warmth, and naturally, with a given atmospheric pressure, the barometer in the warmest spot stands the highest. For every degree increase F., each inch of the column lengthens 1/10,000 in., which amounts to quite a little, as a practical example will prove. Suppose that on a bright June day your barometer stands at 29.6. This same column, under the same air pressure, if cooled from a summer temperature of say 90 deg. to freezing temperature 58 deg. F. lower, would shrink 58 x 29.6 x 0.0001, or 0.17 in., which is nearly 1/6 in. On the other hand, if the reading were taken in January with the thermometer 26 deg. below zero, a correction of 0.17 in. to be added to the reading would be necessary, since freezing point is 58 deg. above the barometer temperature. Therefore:

To correct for temperature: Multiply the column reading in inches by number of degrees above or below 32 deg. F., and multiply the product by 0.0001. If the temperature is above freezing, subtract the correction; if below, add.

2. Altitude. Every 106 ft. of elevation reduces sea-level pressure by about 1/10 in. If your barometer cistern were 1,472 ft. above sea level on that June day, your arithmetic would be like this: 1472/106 x 0.1=1.39 in. Adding this to the reading standardized for temperature, 29.43+1.39=30.82 in. Therefore:

To correct for altitude, divide the elevation in feet by 106 and multiply by 0.1, reading the result as inches and adding to the reading corrected for temperature.

THE extra refinements in scientific barometers, and the extreme care taken in building them, are simply to reduce errors, add to convenience of use, and to increase portability. If you would prefer to make a little more elaborate instrument than the one described, you will find some suggestions in the photographs and drawings on page 65.

In this barometer the upper parts of the guards are replaced with L-shaped ways, so that an indicator can slide upon them. In use this indicator is slid to the approximate position and clamped with the wing screw. Then the cross mark is brought accurately to the mark with a slow-motion screw. A strip of mirror beside the tube reflects the mark and makes the reading doubly accurate.

Instead of depending upon the end of a yardstick to serve as a zero point, another indicator board, also fitted with slow motion, is used. This zero board, which is shown on page 69 in correct relation to the scale rod, is of ¼-in. plywood with a window cut in it to center on the width of the cistern well. It projects ⅛ in. beyond the scale rod so as to run against the scale-rod way. This is to give extra stiffness. Glue a ¼-in. block to the front of the scale rod, and glue and nail the zero board to the back edges of both.

The indicator board, which slides independently at the top of the column, is shown in the lower right-hand corner of the group of drawings on page 65. The opening in the board is rabbeted behind on both sides. The indicator itself is rabbeted at the ends to correspond and slides in the opening. It is held from dropping out of the back by the guides bolted on to clasp the ways. The windows in both indicators may be celluloid or glass with a fine horizontal scratch mark.

For the slow-motion screws, machine screws with small wings soldered in their slots are satisfactory. They can be made to turn without end motion in their brackets by screwing nuts on each side and soldering them.

Note the indicator board clamp. A small sheet-metal angle is housed within the way, and a 3/16-in. round rod is laid in it. A piece of cold-rolled steel, flush with the rabbet, is then pressed against the ways by the point of a wing screw, which wedges between the side of the angle and the round rod.

A door should be fitted to this barometer case, with a small window to enable the rise or fall of the mercury to be seen.

SILK SHIPS IN WORLD'S GREATEST SEA RACE

(Continued from page 15)

and sped it to Los Angeles. As noon whistles blew, the silk, riding ahead of the coaches in a passenger train, started eastward on its final journey, to be watched at every stopping place by secret guardians until, four nights later, its seal was officially broken in the presence of its purchaser.

NOW that the volume of silk is increasing again, railroad officials expect to see the "silk specials" dashing across the continent once more. These fast trains consist only of an engine and three or more baggage cars, each carrying 250 bales of raw silk. They stop only for fuel and water; they cross from Pacific to Atlantic in three nights and days.

Raw silk today costs from $1.20 to $2.35 a pound. One of the largest single shipments of last year totaled 7,000 bales and was worth $2,000,000.

Japan produces nine tenths of the world's silk supply, and ships to the United States nine tenths of her raw silk. More than 500,000 bales pour out through Yokohama and Kobe every year, to be manufactured into articles of wearing apparel and for general use in the United States. Its value today nears $100,000,000.

Recently, through a combination of Yankee and Nipponese scientific and mechanical ingenuity, silk has found several new uses. It serves now to make men's suits, carpets, camping tents, hammocks, fishing nets, alpine ropes, and picnic bags, as well as the scores of objects of art and amusement from national flags to ribbon, which for centuries have been turned out of silk.

Raw silk is not, properly speaking, crude silk, for it has undergone the manufacturing steps of cleaning and reeling into threads. Oddly, although it is thought of as being very fragile, silk has an elasticity comparable to one-half the strength of steel; and it may be woven into cloth as thick as wool or so thin as to be transparent.

Whence comes the raw silk these high-speed motor ships of the silk fleet race across the Pacific? The Japanese silk industry, which, with rice-growing, constitutes a principal source of revenue for Japanese farmers, originated in prehistoric times. Coarse as they once were, goods made of silk have been highly regarded in the Orient for centuries. There was a time when official rank was shown by the amount of silk worn. Women of the exalted families once wore silk *kimonos* and *hakamas* longer than they were tall. At times, they wore twelve extra thicknesses of silk clothing.

ACCORDING to legend, raw silk was the gift of the Chinese Empress Si-ling-chi, the "goddess of the silkworm." But the goddess has had far less to do with silk production than have highly cultivated silkworms.

Each year, the Japanese Government experiment station inspects the crop of silkworm eggs from which 2,000,000 farmers produce cocoons, and destroys the poor ones. About mid-April, when the young buds of the mulberry trees on the leaves of which the worms feed, begin to sprout, the farmer removes the eggs from cold storage to a warmer atmosphere. Within ten days, tiny worms, resembling small ants, break the shells and emerge. From the first day, they eat chopped mulberry leaves, placed on trays.

As the worms eat the succulent leaves, they grow rapidly. After a few days they become quiet, stop eating, and sleep for several hours; then their skins crack and peel off. They sleep four times in the course of their development, and at the end of four weeks are matured and ready to spin their fine cocoons.

At this stage *(Continued on page 106)*

SILK SHIPS IN WORLD'S GREATEST SEA RACE

(Continued from page 105)

they are moved to specially prepared nests made of small straw sticks; there, within a day, they begin to spin their cocoons, to weave the fine threads around themselves. The silkworms gradually shrink as the delicate alkaline filaments are emitted from their mouths, until at last they have lost three fourths of their original size and weight.

TEN days later, if left alone, the chrysalis molts and is transformed into a soft gray moth; it pushes its way through the wall of the cocoon by dissolving the outer layers with a fluid from its mouth. The moths mate; the male dies immediately, and the female lays from 300 to 500 eggs, to complete the life cycle.

Because the pierced cocoon is not suitable for reeling, both by reason of the broken strands of silk and tiny parasites which develop, the farmers deliver their new cocoons to the silk reelers, of which there are 3,700 scattered through Japan, as soon as the cocoons are completed. The raw cocoons are then dried at a high temperature in large ovens; heat destroys both the chrysalis and the parasites. Then they are stored for several weeks, until the time arrives for reeling the raw silk fiber.

The cocoons are formed twice a year, immediately after spring and just before autumn. White cocoons predominate in the spring crop, yellow in the late summer and early autumn. The former produce white silk, the latter yellow. The two crops are about equal in quantity. The cocoons are converted into raw silk at the reeling mills; they become floss silk and material for fine-spun silk yarn; depending upon the quality of the cocoons.

Approximately 320,000 basins are operated in the reeling mills. These basins correspond to spindles in a cotton factory. In them, science and human hands join to unwind from 1,500 to 3,000 feet of fiber from a single cocoon.

THE cocoons are first sorted and, then, because the filaments become hard, are boiled. They become soft and easy to draw off. Then a girl worker, sitting at her basin of hot water, in which scores of bobbing cocoons await their turns at being unwound, slides a brush made of twigs across the surface of several cocoons, and tangles the ends of from five to seven filaments. The number of ends depends upon the quality of silk thread desired.

She quickly injects these filaments through the center of a glass buttonlike end-collector and winds them around a wooden frame. As they unwind, the filaments pass over several glass wheels, and through mechanical twisters which squeeze them tightly into thread, held intact by the softened gum. The girls take great care to avoid breaking any of the filaments, and at the same time keep the single thread running and winding at great speed.

Recently, production of silk has jumped to meet the increased demand in America. Increased production is made possible by a change in the silk-worms, themselves.

Some species have only one life cycle; other species go through the cycle from egg to cocoon twice or oftener within a year. Japanese scientists have found it possible to change a one-life worm into a plural-cycle worm artificially, by immersing the eggs in a secret chemical solution. Scientists can also hasten or retard the time of hatching at the start of the life cycle.

Four pounds of cocoons make one pound of reeled silk, which is the raw silk that is first wound into bundles and finally packed into bales for the race across the Pacific.

MODERN ENGINEERING FEATS ECLIPSE THE WONDERS OF THE PAST

(Continued from page 13)

speeds must have super-highways with surfaces as level as a ballroom floor, free from high spots which might cause accidents. A new roller for roads exerts huge pressure as high spots are met, making a level surface which permits high road speeds without sway.

TO GET dozens of backwoods communities out of the mud, engineers are experimenting with low-cost surfacing materials that can be put down cheaply enough to extend good highways to every part of the country. Metal roads are actually in use—one in the west, where copper-bearing sand, thrown out from the stamp mills, is mixed with asphalt and paving cement for a new highway; another in the east, where cast-iron blocks are used to form the roadbed. In Cleveland, old paving blocks are being placed between and along the tracks of a railway and imbedded in concrete, vibrated into place. Less concrete is needed and cost is cut.

A new twenty-four hour cement aided in building an eighteen-mile New Orleans street. A block at a time, contractors paved it, then let the traffic on it next day. Formerly, concrete pavement had to stand twenty-eight days before traffic could be allowed on it.

As air lines spread their network over the country, new landing fields will swell the number of construction projects. The Philadelphia Post Office now has a concrete street floor upon its roof. It is a 300-by-500-foot landing deck, used for autogiros which will transport mail to the Camden, N. J., airport and return. Out at sea, the 5,000-ton motorship, *Schwabenland,* with a rotating catapult aboard, is anchored somewhere between Africa and Brazil, as a companion to the floating airport *Westfalen* stationed on the air route last year.

Almost every section of our country may soon be transformed through application of modern engineering to its problems. The colossal sum of more than $100,000,000,000 may be spent over the years just ahead if plans of President Roosevelt's National Resources Board are put into effect. Engineers have looked the country over and have found it badly in need of improvements. They say that of the 6,000,000 farms in the United States, only 800,000 have electricity, although a network of giant power lines could provide at least 3,000,000 of them with electricity.

ALMOST 2,000,000 miles of unimproved roads need surfacing; 5,000 dangerous railroad grade crossings must be made safe. Power could be generated at the very mouths of coal mines in Pennsylvania. About 75,000,000 acres of barely productive land need to be taken out of use; millions of acres of good lands elsewhere await only irrigation to make them richly productive—a project which could remake the whole agricultural map of the country. These are some of the ways in which recent scientific advances may be applied soon on a gigantic scale, changing the whole aspect of our country.

LET ME HELP YOU PLAN YOUR CAMPING TRIP

(Continued from page 31)

or opened easily within a half hour.

Nor need you stint yourself. In the boxes of one camping party I saw pancake flour, canned chicken and ham, bacon, eggs, canned milk, coffee, tea, chocolate, lima beans, spinach, asparagus, grapefruit, spanish rice, tomato juice, blackberries, cherries, plums, pears, hominy, apricots, whole new potatoes, and baby beets, all easily packed on the backs of horses. Trout, caught daily by members of the party, formed the backbone of nearly all evening meals.

THERE is no reason for anybody's suffering two weeks of discomfort merely for the privilege of displaying sun and wind burns to his friends. A vacation should be both a change and a rest, even though you may find your rest in exercise. For that reason, I consider the bed the most important camping accessory. In the mountains where nights sometimes are very cold some will prefer double beds. A bed consisting of metal framework and canvas slats will be found comfortable. Either a mattress wide enough to cover the bed or two single mattresses, tied together, may be used.

I prefer a single camp cot with an air mattress. These fold into compact, light bundles and are perhaps more easily transported than other kinds. In any event, remember that cold enters from below as well as from above. In cold country, unless you are using a sleeping bag, place two blankets and a layer of newspapers under the mattress and three or four blankets above. Don't bother with sheets. It is more comfortable to sleep between cotton blankets. Giant safety pins, about four inches long, inserted through all thicknesses of upper covers and mattress at sides and foot will hold the covers together nicely.

Since I recommend camping for comfort, I also recommend hot water bottles. It is better to be criticized than uncomfortable. A severe change from heat to cold may ruin an otherwise enjoyable vacation. In warmer country, of course, you may prefer to sleep on the ground, or on a cot with only a light blanket for cover.

Having provided for your sleeping comfort, remember that burns and bites may easily be avoided. Leave your tent netting tied down during the day. This will keep mosquitoes and flies outside. In mosquito country you will find a lotion made from equal parts of oil of cedar, oil of cintronella, and oil of camphor mixed with petrolatum, to be very effective. A liberal application to face, neck, and hands will keep insects away from your body for a full day.

Head nets of some light, open material may be preferred to the lotion. Take a section of netting about forty inches long and twenty-two inches deep, hem it the long way on both edges and insert a draw string in each hem. Sew the ends together. By drawing the top edge entirely closed over your hat and the lower snugly around your neck you will find freedom from bites. Tuck the lower edge under your sweater or jacket.

WIND burns, particularly to lips and nose, may be bad even in cloudy weather. Cowboys wear large kerchiefs around their necks, not as ornaments, but for protection. By tying a large silk kerchief around the lower part of your face, you will avoid chapped lips. If it slips, hook it over one ear. Here are two novel makeshifts that will protect nose or lips: If you wear glasses, sew a piece of surgeon's gauze to the bridge, spreading it fanlike over the nose; or press the gauze against a small piece of surgical tape, and stick the *(Continued on page 108)*

LET ME HELP YOU PLAN YOUR CAMPING TRIP

(Continued from page 107)

tape to the upper bridge of your nose, again permitting the gauze to extend far enough down to give the desired protection. You can also protect the lips by sticking the tape to the upper lip immediately below the nostrils. The gauze will cover both lips, yet permit you to speak easily.

I WOULD never clutter up a camp with lights. One kerosene or gasoline lantern will serve a camp of almost any size, excepting, of course, a flash light for each tent. I have seen too many cans leaking oil, too many packages of food spoiled, to take chances on transporting more than enough to supply actual needs. By eating the evening meal before sundown, you not only can clear away the dishes by natural light, but be ready to enjoy the camp fire and a sound night's rest to make ready for the next day's efforts. When undressing, lay a flash light across your bed. This gives all the illumination needed in a tent.

Possibly the two most important kitchen aids are a sharp knife and two can openers. The automatic type of can opener works more easily, and a second one in reserve comes in handy if the first becomes dull. Three-compartment plates simplify the serving problem. Place the main dish in the larger compartment, using the two smaller for vegetable and dessert. Be sure the camp ax is of good quality and sharp if you expect to cut much wood. Empty cans, upended, may be used to cover sugar jars and milk cans and to hold tooth brushes. Cups should be of enamel. Tin rusts and dents easily.

Whether you plan to pack into the mountains or take the family on an easy jaunt in the car, be sure to take collapsible chairs and tables. One table, about thirty inches square, rolls up into a bundle the size of your arm and will accommodate at least four people. Folding chairs with canvas backs and seats are particularly comfortable. Some types make a compact bundle no longer than two feet and four inches in diameter. These may be packed easily on the floor of the car.

Perhaps these few, simple suggestions based on my long experience in packing city people into the Sierras, will help to make your camp vacation what it should be—a real rest.

CAMP SITE IN ROCKIES USED BY PRIMITIVE MAN

MYSTERIOUS Americans roamed the Rocky Mountain region 20,000 years ago. This fact has just been uncovered by the discovery of an enormous camp site and work shop in the foothills of the Rockies. It is almost half a mile across and is covered with about twenty feet of dirt. Stone dart points and the bones of prehistoric animals that lived when glaciers of the Ice Age covered great areas of the United States, are being examined by scientists to learn new facts about these people, thought to have been the first Americans.

CREATING BEAUTIFUL NEW FLOWERS

(Continued from page 52)

the fall, to be washed down by winter rains, or four weeks after planting.

A few days after the first watering, you can give the plants a good soaking. From that point on, you may cultivate by hand or with a rake twice or three times between waterings. This method not only saves water bills, but is better for the plants. Loosening the surface forms a mulch and preserves the moisture, by preventing evaporation through the many capillary tubes which form in the soil around the roots.

TO AVOID disease in the garden you will do well to select resistant strains. Good preventives and insecticides are easily obtained. You may enjoy counter-attacking some of the more virulent diseases, such as stem rot in asters or black spot in roses, for the diseases themselves ruin a garden quickly. Black spot may be beaten back with a good dust or spray, but stem rot is caused by a disease fungus of the soil. Here is a challenge worthy of man's best genius.

Some years ago, stem rot was attacking asters in many countries. This fungous growth, which thrived on both the root and the whole plant, made so widespread an appearance that something had to be done. It had been known to live twenty years in soil where there were no asters, though it did not attack other plants.

When faced with this problem, I decided to meet the disease on its own terms. I planted asters in diseased ground. The first year only two or three plants survived on each acre of plantings. I planted seeds from those survivors the following years. Gradually, by careful selection, I evolved a resistant strain which now defies the fungus and thrives readily. Whether the defense is a chemical reaction or a tougher plant cell I do not know; but use of resistant strains is the only way in which to overcome the ravages of stem rot. Nor does the disease have any apparent effect on color. White flowers which are supposedly weaker, attain a size and beauty equaling if not surpassing that of the reds. You can meet like problems similarly in your own garden.

Roses offer a problem all their own. Crossing season. Good pruning is essential if you ist and requires a longer time than seed plants. You can, however, bud successfully, though grafting is seldom practiced.

All roses should be pruned after the flowering season. Good pruning is essential if you desire full-bodied, fragrant flowers. On a young bush, say not older than two years, prune back severely, leaving only three stalks from twelve to eighteen inches long. On older plants, more and longer stems may be left, but these should never be more than thirty inches long. The more severely you prune, the more suckers and longer stems will come out next spring.

BUDDING may be undertaken from March to September in regions of mild or warm climate; in the east, it should be done in March. First, select a husky root stock. Scoop away the earth to expose the root. Take the bud from a stalk which has borne a rose, cutting it away near a leaf stem. The stem will enable you to handle the bud without injury. With a small, sharp knife, split the bark immediately below the union of root and stem, making a "T" just large enough to take the bud. Lift the corners of the "T," slip the bud beneath, and bind the wound. I have found it a good plan to use a rubber band for this purpose. Wrap the rubber several turns around the wound, taking care not to cover the bud, and tie. The rubber will gradually deteriorate, making further care unnecessary. *(Continued on page 109)*

YOU, TOO, CAN CREATE BEAUTIFUL NEW FLOWERS

(Continued from page 108)

Selection of a strong, resistant root stock is important; most fancy varieties show low resistance.

Tree roses should be pruned back and climbers thinned out according to your personal preference. Climbers may be budded on tree roses. If you want a variety of colors you may place as many as four buds, one of each color, near the top of each stalk. A climber stock budded to a tree rose will give an interesting weeping effect. Bush roses generally should not be budded on climbers, though a bush budded to a long stalk of a ragged-robin will grow successfully.

YOU may conduct your crossing experiments with annuals with every confidence of interesting and successful results, for the seeds of new varieties available from seed stores throughout the nation have been tested by ten of the country's leading experts and found to be hardy, healthy, vigorous and true to color and type. These ten experts are members of the All America Selection Committee, of which W. Ray Hastings of Atlanta, Ga., is chairman.

Each year, seed growers submit new species to the committee. For the 1935 season, 139 entries were submitted. The judges planted seed from all entries, identified by number and not by the originator's name, and, by secret vote, chose fifteen as worthy of presentation to the nation's amateur gardeners.

From these, a new orange cosmos was selected grand champion. This easily grown flower blooms in ninety to 100 days after planting; older varieties take six months. The beauty of the orange cosmos was an important reason for its selection.

The committee, established in 1932 at Atlanta under the auspices of the Southern Seedsmen's Association, and now jointly sponsored by that organization and the American Seed Trade Association, conducts the trials in the several climatic and geographical sections of the United States and names, in order of their garden importance, worthy new items. The committee recognizes worthy new species, varieties, and strains.

Seeds reaching you through dealers are grown and harvested on large ranches, of hundreds of acres. Nasturtium plants, for instance, are cut off at the soil when the majority of the plants are matured. Immediately they are rolled into balls to prevent the seed dropping. Although the plants are green when cut, the food stored in them matures the seed rapidly. Four days after cutting, the plants are spread on large sheets of canvas, and are shaken every two days until all seeds have dropped off. Finally, the seeds are cleaned by air and screens; then they are ready for distribution. From these you can continue hybridization and selection, and achieve perhaps even greater beauty and hardiness than have the professional growers.

INCUBATOR FOR EGGS OF RARE BIRDS MIMICS HEN

DEVISED for hatching the eggs of rare birds in the Moscow, Russia, Zoo, a new incubator imitates the methods of the birds themselves. The ordinary incubator heats the eggs uniformly throughout. The new apparatus heats the top of the eggs several degrees warmer than the bottom and allows them to cool off occasionally, just as they do under natural conditions when the mother bird leaves her nest. The complete heating and cooling schedule is set for twenty-four hours in advance by the scientist in charge of the incubator, and the machine automatically follows the cycle.

LABORATORY OF WARFARE KEEPS OUR ARMY UP-TO-DATE

(Continued from page 36)

wheelbarrow. Gas and oil will be transported in the same way, abolishing the gasoline tank truck. These changes will simplify manufacture and operation of vehicles for use in the field.

The Department of Experiment aims, wherever possible, to standardize field equipment. For example, tests are now being made to evolve a standard portable footbridge.

To cross a stream, in the face of a storm of lead and steel from an enemy holding the opposite bank, is one of the most desperate tasks that face soldiers. While crossing, they can hardly fight back. Many may be killed and wounded, while more may be drowned if the bridge collapses, or is shot from under them. Often they must bring their own bridge and build it under fire. The bridge must be not only strong, but light and compact.

NOT long ago, in realistic maneuvers, the 29th silently and in darkness sneaked up its material, laid it over the unfordable Upatoi creek, and triumphantly, in face of chattering machine guns, crossed upon it. The planks were of waterproofed white pine. For the floats, three materials were tried—tin cans, puffed rubber, and balsa wood.

The tin cans—large ones, of course—were cheap, light, and very satisfactory, until machine guns punctured them. The rubber had been exploded in the presence of a gas that expanded it into a spongy mass. It and the balsa wood were shot full of holes, but lost little buoyancy. But after the 29th had marched and countermarched over the narrow footway, and tested it in every way, the verdict was in favor of balsa.

But troops can get from place to place more quickly through the air, than over a footbridge. The British in Palestine, the French in Africa, have done it in wars with hostile tribesmen, dealing surprise strokes out of the blue. Our Army has never done it in war, but we are now ready to hurl through the air a war-strength Infantry battalion: doughboys, packs, rifles, machine guns, one-pounder cannon, trench mortars, and ammunition. Benning has been experimenting on the problem, calculating to the last ounce how many "flying doughboys" and what equipment could be squeezed into a twelve-passenger transport.

Peace-time maneuvers are tricky enough, but war brings additional troubles. Using war-worn maps, a column of troops may go marching down a folded crease that looks like a road, or get surrounded on a smudged spot made by little drops of water. Rain may turn maps into pulp. Or might, until the Department of Experiment went into the kitchen and found that innocent cooking paper makes the best war maps. Made to stand heat and grease, it has been soaked in water or carried folded in pockets for weeks, without damage. So the paper on which Mother bakes cakes will win or lose battles.

DISCOVERIES no less surprising are making the infantryman more formidable in battle. Until the World War, he fought with rifle and bayonet. Today he has automatic pistols, one-pounder cannon, hand grenades, trench mortars, Browning heavy and light machine guns. Those Brownings were the best in the World War; Benning experiments have improved the heavy gun with a new recoil mechanism, and provided the light gun or automatic rifle with a folding shoulder piece and a bipod at the center of gravity. It can be fired lying down, at ground troops, or, propped up by an ordinary rifle, at airplanes.

In 1918, French soldiers threw away their own rifles for discarded American Springfields; now that Springfield is to be superseded. It fired three and a half miles, ten shots a minute. It gives way to a remarkable new semi-automatic rifle firing thirty to sixty shots a minute just as accurately, and less tiringly to the marksman. The current appropriation bill provides 1,500, which is just a beginning. When the 29th finishes getting the bugs out of the new model, it will do things to modern warfare. It shoots the new long-range streamlined bullets that were models for streamlined trains and automobiles.

This bullet is fired by the .30-caliber machine gun, the "heavy gun" of the World War. But there is a heavier gun now, the .50-caliber, recently much improved to shoot down an armored airplane or puncture the steel hide of a tank, or for use as the main weapon of our own tanks. Now, both these guns, and the trench mortar, are made more deadly by Capt. Sidney H. Negrotto's six years' work on an all-purpose machine-gun mount, of which the first completed specimen has just reached Benning.

IT IS a triumph of simplicity. By cutting out unnecessary parts, Captain Negrotto reduced the weight of the old mount six pounds. Release one bolt, and the gun can be instantly uptilted to spit bullets at an airplane—sixteen to the minute. The new mount makes the gun fifty percent more accurate.

The Army is economizing, like every one else, and to save ammunition Benning is experimenting with ways to teach soldiers to shoot without burning any powder. One method uses a device that throws onto the target a pattern of light almost the exact size of the pattern of bullet marks a machine gun would make at the same range. Pulling the trigger causes a spot of light, the size of a bullet hole. Sometimes it flashes on, then off, just as a machine gunner fires one burst, then another. Sometimes the stops are longer, like "jams". A sounding box makes a racket all too realistic. The whole thing can be put into a cigar box attached to the machine gun: a flash light bulb and socket, a stereopticon lens, a switch, and some wire. Total cost, $5; total saving in ammunition, many times that.

Another way to save money is to turn from brass an exact replica of a one-pounder cannon shell. Then, through the center of the base, where the cap would be, drill a hole just large enough to take a .45-caliber pistol cartridge. Put the shell-cartridge combination into the breech of the cannon, and fire at your target. There have even been experiments in firing .22-caliber cartridges at a cost of $3 for 1,000, as against $30 for 1,000 for the 45-caliber.

There is also an ingenious indoor anti-aircraft range especially good for Northern climates where there is much darkness. A demonstration is much like a visit to a movie. The room is darkened, and its 100-foot firing range leads down to a screen of white paper in a heavy wooden frame. In the sides of the frame, backed by reflectors, are eight 200-watt lamps. These make the paper luminous. A silhouette appears upon it—the shape of an airplane.

"Rat-tat-tat-tat!"

The machine gunners are at it, trying to drill that sky-hawk, before he can theoretically drill them with his own machine gun, or blow them to pieces with his bombs. The bullets puncture the paper screen and strike a bullet-proof sheet-metal backstop. If a bullet hits the black silhouette of the airplane, a beam of light shines through from the lamps.

THE Army's anti-aircraft range at Camp Perry, Ohio, also has moving targets simulating airplanes, something like a Coney Island shooting gallery. *(Continued on page 111)*

LABORATORY OF WARFARE KEEPS OUR ARMY MODERN

(Continued from page 110)

The average reader hears so much about airplanes and air raids in "the next war", that he forgets the progress in devices to bring down those airplanes and break up their raids. Not only are anti-aircraft cannon and machine guns more effective, but the devices for listening, aiming, and firing have also been greatly improved.

IN OUR Army, tanks are no longer a separate corps, but a weapon of infantry and cavalry. Not long ago they drove out to a secluded spot on the Fort Benning reservation, a tank of war-time type, but with good, tough 3/5-inch steel armor. Inside the tank, where the crew would ride, were placed painted dummies representing men. Then, upon the ground soldiers set up a strange, spider-like tripod, bearing a machine gun of foreign design. This they aimed at the tank, and pulled the trigger. From the weird gun's muzzle drove bullets. Their crashing upon the tank's armor, was followed by the sound of explosions within the tank.

An officer walked over to the tank, reached in, and brought forth the dummy soldiers. Each was punctured and torn with bullet marks; some seemed to have been shredded, as by explosions. The bullets that had been fired had a steel core, but coated with soft lead and copper so that when they hit the tank, the tip mushroomed and clung for a fraction of a second. The steel core drove through the armor and into the tank. Within the steel core was an explosive charge which detonated in the interior of the tank. The dummies showed the effect.

Since 1918, there have been great improvements in tanks, worked out by the Ordnance Department and the Infantry. Engine cooling has been bettered, anti-aircraft guns and pistol portholes added. Remote control of some guns may be possible. Tanks may be protected against gas by adding a power-operated blower to filter the air. Tank crews may wear gas masks fitted with a laryngophone, a sort of metal membrane held against the wearer's larynx, which when talking, vibrates the membrane. The tank commander will direct his fleet by radiotelephone, for which special helmets have been devised. The most important defensive tank improvement has defeated the tank driver's dreaded enemy, the burning hot lead that comes spattering into his eyes from bullets fired at his narrow peep slot. The peep slot has now been insulated with a new, non-inflammable transparent laminated glass and a material like celluloid.

WHAT seemed the greatest offensive improvement in tanks, was speed. Here was something that might revolutionize modern warfare—a land battleship with armor too thick to be penetrated by ordinary rifle or machine-gun bullets, and moving too fast for artillery to hit it except by chance. Here was something infinitely more powerful than the World War knew, a weapon, sudden and swift, thrusting through, rapierlike, to a vital part, defying resistance.

But while the World War knew armor-piercing bullets as a defending shield, 1935 knows not only better tanks, but better armor-piercing bullets. Especially, explosive bullets. Tank advocates, notably Captain George A. Rarey, author of "The Fighting Tanks Since 1916," state that modern tanks, when used en masse, will constitute one of the most serious defense problems with which armies will have to deal. Will the actual test of battle show that the defense has indeed found a shield, in bullets that not only pierce armor effectively, but, when they have pierced it, explode inside? Will a new wrinkle once more change the course of history?

AUTO RACING IMPROVES PASSENGER CARS

(Continued from page 79)

be made popular with the man of average income and average driving skill, smaller motors would have to be developed.

In accordance with their policy of making the Indianapolis race a proving ground for development along desired lines, the men responsible for framing the entry conditions for the 1920 race limited piston displacement to 183 cubic inches. By 1926 progressive reductions had gotten it down to ninety-one and one half cubic inches.

The builders of racing cars met the challenge by turning out small high-compression engines that produced high horsepowers because they ran at high speed—up to 5,000 and even 6,000 revolutions per minute. Although the new engines were only one sixth the size of those used in the race fifteen years earlier, they developed more than seven times as much horsepower, and used less fuel and oil. They could drive the little 1,450-pound racing cars at 100 miles per hour.

AGAIN the lessons learned in racing were applied to the building of passenger cars. Smaller engines made automobiles cheaper, and high-speed, high-compression engines gave more economical and smoother performance.

By 1930 the guardians of the Indianapolis race had decided that the low limit on engine size had accomplished its purpose. The waspish little racers were too fast, they said, and fatal racing accidents much too numerous. So they increased the displacement limit to 366 inches, demanded that each car's weight be in due proportion to its power, and ruled that a mechanic must ride with the driver.

Again the builders of racing cars met the challenge, and so successfully that the last three Indianapolis winners have averaged over 104 miles an hour!

Most of us can remember when tires were guaranteed for only 1,000 miles. Just a few years ago we were satisfied if we got 3,000 miles of service at top speeds of from forty to fifty miles per hour. Now we expect between 15,000 and 30,000 miles from our tires, at top speeds up to eighty miles per hour.

Racing deserves much of the credit for this tremendous improvement in tires. Race drivers were the first to demand treads that would not come off. They were the first to recognize the superior safety of the straight-sided tire. And they were the first to use the now universal balloon tire. To racing also must go most of the credit for the development of the demountable rim, and the introduction and popularization of the wire wheel.

Racing remains of high value to the automobile industry. Last year one manufacturer obtained a twenty-one percent increase in horse-power over his 1933 car without increasing the displacement of his engine. Racing had taught him things about carburization, piston and cylinder-head design, and the advantages of various metals, that made the improvement possible. Another manufacturer took advantage of stock-car road-racing experience to strengthen a part of his car that never had shown weakness in ordinary service.

Racing will go on. Speeds will increase. Kaye Don, a famous British speedster, forecasts that within the coming four years some dare-devil pilot will drive at the rate of 350 miles per hour. And every time a record is broken, the automobile industry will learn things that will help it to produce better cars.

As Sir Malcolm Campbell, the little Scot who is the only man left alive of the five who have driven at speeds greater than 200 miles per hour, is fond of saying:

"Only by adventuring and pioneering is progress possible."

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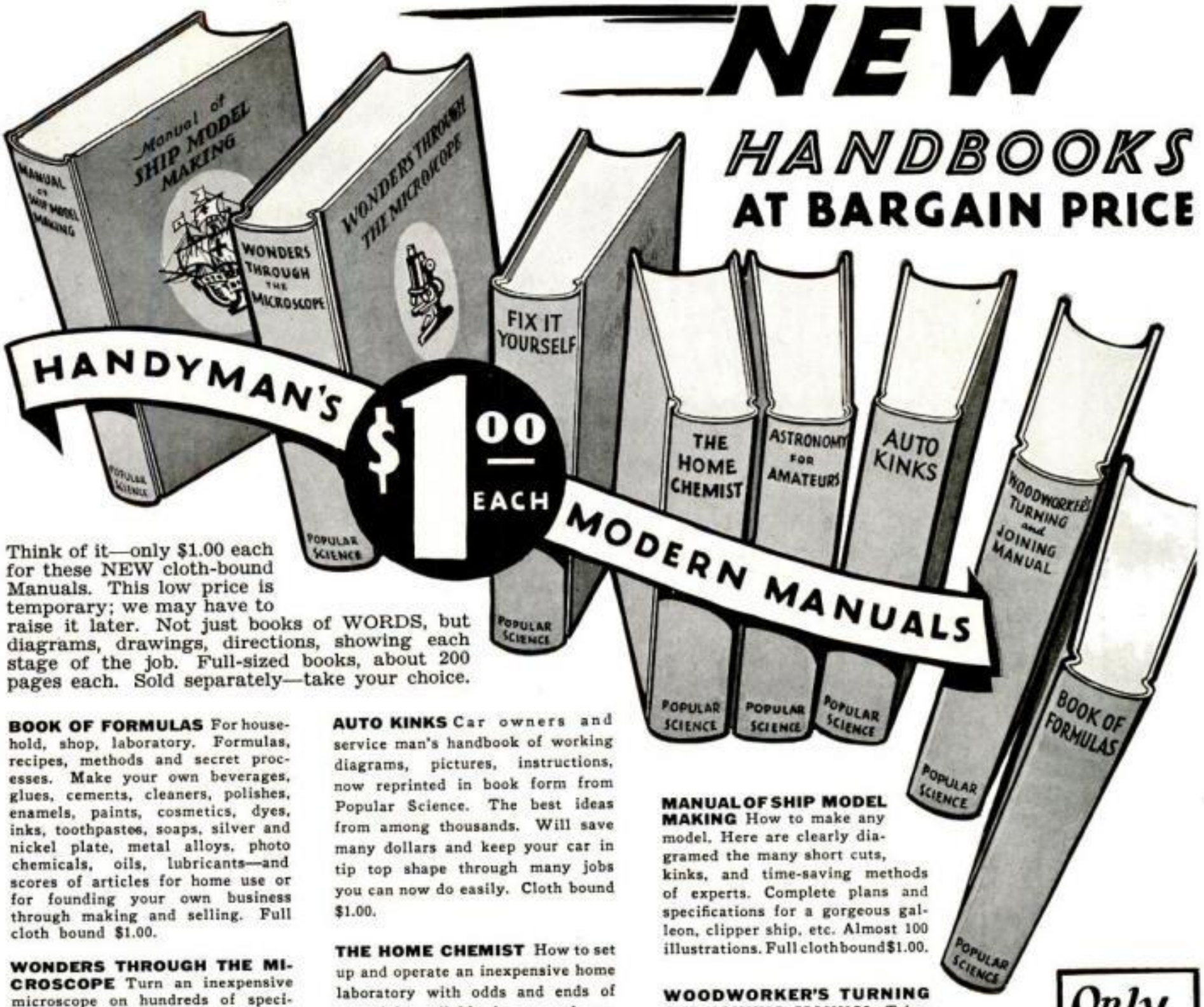

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